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A Short Course in

Canon EOS Digital Rebel Photography

Dennis P. Curtin

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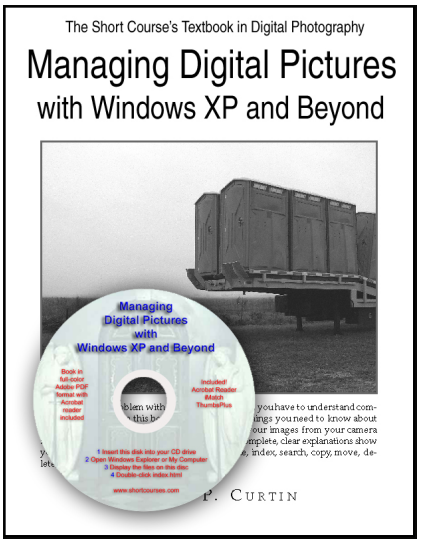
CANON WEB SITES

To learn more about the Digital Rebel, visit these Canon web sites:

■ http://www.canoneos.com

■ http://www.canon.co.jp/Imaging/BeBit-e.html.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with Windows XP and Beyond
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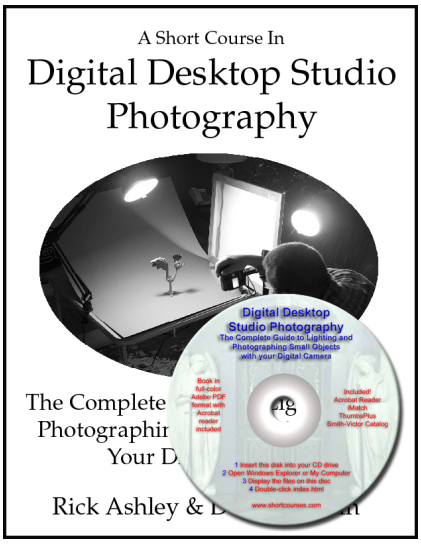
P. Curtin



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PREFACE

The Canon EOS Digital Rebel is a full-featured SLR with interchangeable lenses.

A great photograph begins when you recognize a great scene or subject. But recognizing a great opportunity isn't enough to capture it; you also have to be prepared. A large part of being prepared involves understanding your camera well enough to capture what you see. Getting you prepared to see and capture great photographs is what this book is all about. It doesn't matter if you are taking pictures for business or pleasure, there's a lot here to help you get better results and more satisfaction from your photography.

To get better, and possibly even great photographs, you need to understand both concepts and procedures; the "whys" and "hows" of photography.

■ Concepts of photography are the underlying principles that apply regardless of the camera you are using. They include such things as how sharpness and exposure affect your images and the way they are perceived by viewers. Understanding concepts answers the "why" kinds of questions you might have about photography.

■ Procedures are those things specific to one kind of camera, and explain step-by-step how you set your camera's controls to capture an image just the way you want. Understanding procedures gives you the answers to the "how" kinds of questions you might have.

The EOS Digital Rebel accepts the full line of Canon EF lenses.

This book is organized around the concepts of digital photography because that's how photographers think. We think about scenes and subjects, highlights and shadows, softness and sharpness, color and tone. The procedures you use with the Canon EOS Digital Rebel, called the EOS 300D in some countries, are integrated throughout the concepts, appearing in those places where they apply. This integrated approach lets you first understand the concepts of photography and then see step by step how to use the Digital Rebel in all kinds of photographic situations.

To get more effective, interesting, and creative photographs, you only need to understand how and when to use a few simple features on your camera such as focus, exposure controls, and flash. If you've previously avoided understanding these features and the profound impact they can have on your images, you'll be pleased to know that you can learn them on a weekend. You can then spend the rest of your life marveling at how the infinite variety of combinations they provide make it possible to convey your own personal view of the world. You'll be ready to keep everything in a scene sharp for maximum detail or to blur some or all of it for an impressionistic portrayal. You'll be able to get dramatic close-ups, freeze fast action, create wonderful panoramas, and capture the beauty and wonder of rainbows, sunsets, fireworks, and nighttime scenes.

As you explore your camera, be sure to have fun. There are no "rules" or "best" way to make a picture. Great photographs come from using what you know to experiment and try new approaches. Digital cameras make this especially easy because there are no film costs or delays. Every experiment is free and you see the results immediately so you can learn step by step.

This book is about getting great pictures, not about installing batteries and connecting your camera to your computer and using your software. That information is well presented in the user guide that came with your camera. Be sure to visit our Web site at www.shortcourses.com for even more digital photography information.

PHOTOGRAPHY ON-LINE

The contents of this book are constantly updated, enhanced, and expanded on-line. To learn more about digital photography, visit our ShortCourses Web site at www.shortcourses.com.

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Chapter 1
Camera Controls and Creativity

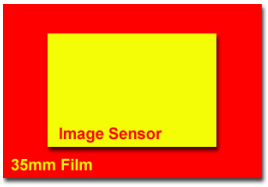
CONTENTS

■ The Digital Rebel Camera ■ Jump Start: Using Full Auto Mode ■ Good Things to Know ■ Operating the Camera ■ Using Menus to Change Settings ■ Managing Your Images ■ Selecting Image Quality and Size

Serious digital cameras give you creative control over your images. They do so by allowing you to control the light and motion in photographs as well as what's sharp and what isn't. Although most consumer digital cameras are fully automatic, some allow you to make minor adjustments that affect your images. The best ones such as the Canon EOS Digital Rebel offer interchangeable lenses, external flash connections, and a wide range of controls—more than you'd find on a 35mm SLR. However, regardless of what controls your camera has, the same basic principles are at work "under the hood." Your automatic exposure and focusing systems are having a profound affect on your images. Even with your camera set to operate automatically, you can indirectly control, or at least take advantage of the effects these systems have on your images.

In this chapter, we'll first explore your camera and how you use it on Full Auto mode. We'll also see how you use menus and buttons to operate the camera, manage your images and control image quality. In the chapters that follow, we'll explore in greater depth how you take control of these settings, and others, to get the effects that you want.

THE DIGITAL REBEL CAMERA



The Digital Rebel's image sensor is smaller that a frame of 35mm film, but has the same familiar shape.

The Digital Rebel, called the EOS 300D in some countries, is a small single-lens reflex (SLR) camera with a durable but light weight polycarbonate body and interchangeable lenses. The camera's image sensor captures images up to 3072 x 2048 pixels (6.3 megapixels) using the same 3:2 width to height aspect ratio found in 35mm film.

Single-lens reflex cameras have been around for a long time, and have always been the favorite of serious photographers. One reason is that you can see the scene you're photographing through the lens instead of through a separate window. You can also see which part of a scene will be in sharpest focus and preview depth of field. The light from a scene enters the camera's lens, bounces off a mirror, is reflected up through a prism and out the viewfinder. When you take a photo, the mirror swings up out of the way so the light can pass through the shutter to expose the image sensor.

The Digital Rebel is an SLR (single-lens reflex) camera. When you look in the viewfinder you see the scene through the lens.

One of the best things about the Digital Rebel is that it can use most, if not all, Canon EOS series accessories without modification. This opens up a wide range of creative possibilities. For example, you have over 60 Canon lenses to choose from, and the E-TTL autoflash-compatible hot shoe accepts a wide assortment of Canon EX-series external flash units including some designed for close-up photography.

The camera has a buffer that stores images until they are fully processed and stored on the flash card. Since storing images to the buffer is a lot faster than storing them to the card, the click-to-click time between taking images is shortened. The buffer allows the camera's continuous mode to capture up to 4 images at 2.5 frames per second. Images are saved to either a Type I or Type II Compact Flash (CF) card, including the IBM Microdrive.

The Digital Rebel supports the industry standard PictBridge so you can connect the camera to photo printers and other PictBridge devices and print images without a computer. With Canon's CP-300 4" x 6" photo printer and a battery pack you don't even need an AC power connection.

IN THE BOX

Camera with eyecup, body cap and lithium backup battery for the date and time, EF-S 18-55mm zoom lens with caps (optional), battery pack BP-511, battery charger CB-5L, USB interface cable IFC-300PCU, video cable VC-100, neck strap EW-100DB ll with eyepiece cover, EOS DIGITAL Solution Disk, Adobe Photoshop Elements Disk, Pocket Guide, manuals/instructions for camera, software installation and use, battery pack, and a warranty card.

JUMP START: USING FULL AUTO MODE

Power switch, Mode Dial, and shutter button.

Full Auto icon.

SLEEP MODE

If you don't use any controls for 1 minute, the camera enters sleep mode. To wake it up, press the shutter button halfway down and release it. To change the auto power off time, see page 113.

TO FLASH OR NOT

When you press the shutter button halfway down in Full Auto mode, the flash pops up and fires in dim light, or when the subject is backlit. This also happens in other Basic Zone modes other than Sports, Landscape, and Flash Off (page 24). It does not happen in Creative Zone modes (page 23).

The Digital Rebel's Full Auto mode sets everything for you. Just frame the image and push the shutter button. This is the best mode in most situations because it lets you focus on the subject rather than the camera.

■ **Selecting the mode**. Turn the power switch on the top of the camera to *ON* and set the Mode Dial to Full Auto (the green rectangle icon).

■ **Framing the image**. The viewfinder shows you about 95% of the scene you are going to capture. If the image in the viewfinder is fuzzy, turn the diopter adjustment knob to the right of the viewfinder to adjust it. (The focal length of your lens is longer than the same lens is on a film camera—see page 80.)

■ **Autofocus**. When you look through the viewfinder, you see seven small rectangles—the focusing or *AF points*. If the lens focus switch is set to AF (page 53), the camera will focus on the closest subject covered by one or more of these focus points (page 53). When you press the shutter button halfway down, a red dot flashes in the focusing point or points being used to set focus, the round focus confirmation light in the lower right corner of the viewfinder glows green, and the camera beeps. How close you can focus depends on the lens you are using.

■ **Autoexposure**. When you press the shutter button halfway down to activate the displays, the shutter speed (page 26) and aperture (page 28) that will be used to take the picture are displayed in the viewfinder and on the LCD panel above the viewfinder.

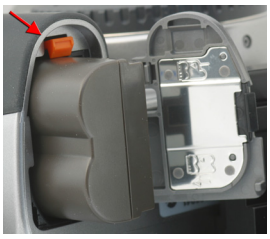
■ **Autoflash**. If the light is too dim in Full Auto mode, the built-in flash automatically pops up when you press the shutter button halfway down and fires when you press the shutter button the rest of the way down (page 93).

■ **Automatic white balance**. The color cast in a photograph is affected by the color of the light illuminating the scene. The camera automatically adjusts white balance so white objects in the scene look white in the photo (page 64).

QuickSteps TAKING A PICTURE IN FULL AUTO MODE

1. With the power switch on the top of the camera set to *ON*, set the Mode Dial next to the power switch to Full Auto (the green rectangle icon). Set the focus mode switch on the lens to AF (page 53).
2. Compose the image in the viewfinder, making sure the area that you want sharpest is covered by one of the seven focus points.
3. Press the shutter button halfway down and pause so the camera can automatically set focus and exposure. When the camera has done so it beeps, the round green focus confirmation light in the viewfinder glows, and the focusing point(s) being used to set focus flashes red.
4. Press the shutter button all the way down to take the picture.
   - The shutter sounds, *buSY* is briefly displayed in the viewfinder, and the red access lamp on the back of the camera flashes as the image is stored.
   - The image is displayed on the monitor for 2 seconds so you can review it.
5. When done shooting, turn the power switch to *OFF*. If an image is being saved the camera will complete that task before shutting down.

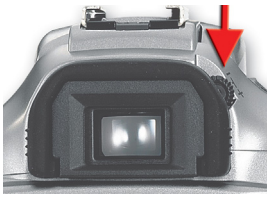
GOOD THINGS TO KNOW



The battery compartment cover is on the bottom of the camera. One rechargeable lithium BP-511 (or 512) battery pack will capture over 600 images in warm weather when not using flash.

Icons show the status of the battery as full (top), almost run down (middle), and out (bottom).

The CF card slot cover is on the right side of the camera as seen from the shooting position.



Diopter adjustment knob.

When you first start taking photos, it sometimes seems that there is too much to learn all at once. To simplify getting started, here is a list of some of the things you may want to know right off.

■ The first time you use the camera you should enter the date and time (page 113). These can be used later to organize and locate pictures.

■ If your camera is right out of the box you have to mount a lens (page 78), insert a charged battery pack, and insert a CompactFlash (CF) card on which to store your images. No CF card is included with the camera.

■ To insert a CF card, turn off the camera, slide the CF card slot cover on the right side of the camera toward the back, and swing it open. Insert the CF card with its front label facing the rear of the camera and press it in until the eject button pops out, then close the cover. To remove a card, open the CF card slot cover and press the eject button to pop up the card so you can grasp it. Never open the battery or CF card slot cover when the red access lamp next to the cross keys on the back of the camera is on. Doing so can cause you to lose images, or even damage your CF card.

■ To take pictures hold the camera in your right hand while supporting the lens with your left. Brace the camera against your face as you look through the viewfinder and brace your elbows against your body. Press the shutter button slowly and smoothly as you hold your breath after breathing in deeply and exhaling.

■ If the light is dim, and the camera can't focus in Full Auto mode, the built-in flash (page 53) pops up and strobes to assist autofocus.

■ You can use the camera's monitor to review images you've taken but not to take photos. You can adjust the monitor's brightness to match the light you're viewing it in (page 113).

■ When you press the shutter button halfway down you activate the viewfinder and LCD panel above the monitor and icons or other indicators are displayed for the current settings. Some remain displayed for only a few seconds unless you use a control. You can illuminate the LCD panel by pressing the LCD illuminator button on the back of the camera (page 73).

■ The camera's focus confirmation beep can be turned off (page 115).

■ When you take a picture, it is displayed on the monitor for two seconds but you can extend the review time, or change what's displayed (page 113). When an image is displayed, you can press the Erase button (page 13) to delete it.

■ To adjust the viewfinder (-3 to +1 dpt), remove the lens cap and look through the viewfinder at a fairly bright light source (not the sun!!). If the display in the viewfinder isn't sharp, try to bring it into focus by turning the diopter adjustment knob to the right of the viewfinder. If this won't work, you may need a visit to your eye doctor to find out what accessory lens you need. The camera accepts the accessory Dioptric Adjustment Lens E that comes in 10 types ranging from -4 to +3 diopters to match your eyesight. These lenses slip into the viewfinder's eyepiece holder.

■ You can reset all camera settings to their factory defaults (page 113). This is useful if you make changes and can't remember how to undo them.

Operating the Camera

TIPS

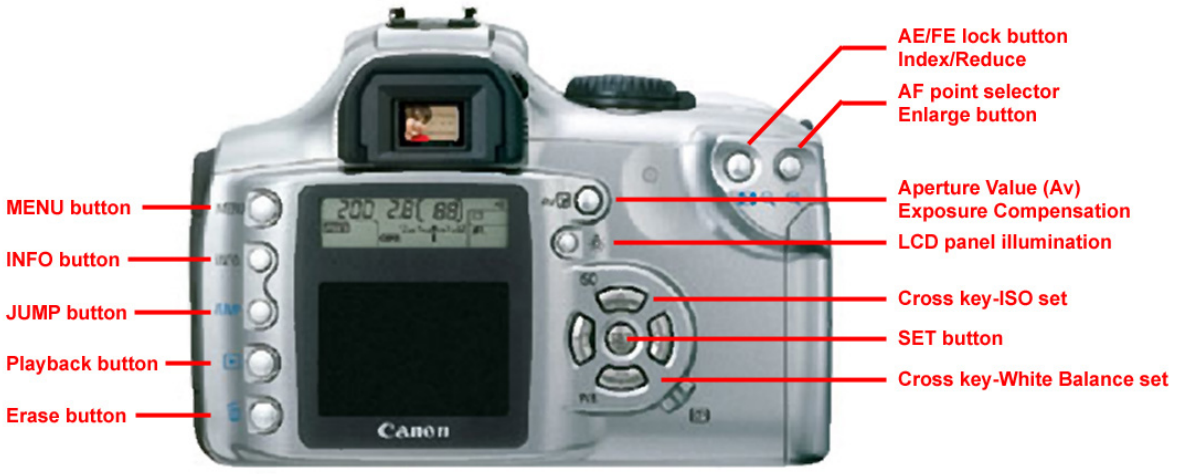
- Buttons won't work when the camera is in sleep mode. Press the shutter button down and release it to wake up the camera and activate the LCD panel display.
- You can quickly reset camera settings to their original factory defaults (page 113).

The Digital Rebel has a number of buttons and dials that quickly change important settings without the time-consuming need to display menus and select commands. In many cases, buttons and dials are used together in sequence. Pressing a button initiates a procedure, and then turning a dial selects the available options. In these cases, when you press the button, you only have about 6 seconds to turn the dial or the command is cancelled.

TOP VIEW

- **Lens release button**, when depressed, lets you turn the lens to remove it (page 78).
- **Flash button** pops up the built-in flash when the Mode Dial is set to any mode in the Creative Zone (page 23).
- **Shutter button** locks in exposure and focus and turns on the viewfinder and LCD panel information display when pressed halfway down, and takes the photo when pressed all the way.
- **Main Dial** is used to change settings. In some cases, as when selecting the autofocus point (page 55), using program shift (page 25), setting the ISO (page 48) or white balance (page 65) you first press and release a button to select a setting before you turn the dial. In other cases, you turn the dial by itself to change shutter speeds and apertures (pages 26–30). In playback mode, it scrolls through pictures (page 13).
- **Mode Dial** selects one of the many exposure modes offered in the Basic and Creative Zones (page 23).
- **DRIVE mode button** cycles the camera among single-shot, continuous shot (page 112), and self-timer/remote control (page 48) modes each time you press it.
- **Power switch** turns the camera on and off.
- **Depth of field preview button** (not shown) next to the *Digital Rebel* or *300D* logo on the front of the camera lets you preview depth of field in the viewfinder in some shooting modes (page 57).

Drive mode icons include continuous (top), single (middle), and self-timer/ remote control (bottom).

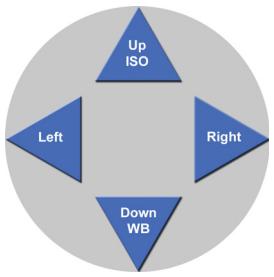


REAR VIEW

■ **Menu button** displays and hides the menu on the monitor (page 12).

■ **INFO button** displays or hides information about camera settings in shooting mode, or the currently displayed image in playback mode.

■ **JUMP button** jumps you though menus (page 12), and between pictures in playback mode (page 13).



The cross keys on the back of the camera and what they do.

■ **Playback button** displays the last image you captured (page 13). It also returns the image to full-screen display when zoomed or displayed as one of 9 thumbnail images (page 13).

■ **Erase button** deletes the image displayed on the monitor or all images stored on the CompactFlash card (page 13).

■ **AE/FE lock and Index/Reduce button** (*) locks exposure (page 41) and flash exposure (page 101). In playback mode this button unzooms a zoomed image and switches to and from index view (page 13)

■ **AF Point/Enlarge button** manually selects which focusing point in the viewfinder is used to set focus when you hold it down and turn the Main Dial (page 55). In Playback mode it zooms the image up to 10x (page 13).

■ **AV/Exposure Compensation button** is used along with the Main Dial to set the aperture in manual (M) exposure mode (page 30), and to set exposure compensation in other modes (page 101).

■ **LCD Panel Illumination button** lights the LCD panel.

■ **Cross Keys** move the highlight while using menus and scroll images in playback mode**.** In shooting mode, pressing the up cross key (▲) and then turning the Main Dial changes the ISO (page 48). Pressing the down cross key (▼) and turning the Main Dial sets white balance (page 66).

■ **SET button** in the middle of the cross keys confirms settings.

USING MENUS TO CHANGE SETTINGS

TIP

■ When menus are displayed on the screen, you can press the shutter button halfway down to instantly return to shooting mode.

Shooting menu tab icon.

Playback menu tab icon.

Set-up 1 menu tab icon.

Set-up 2 menu tab icon.

To change settings, you often use a menu that is displayed on the monitor when you press the MENU button. Commands are listed on four tabbed pages that you navigate with the JUMP button, Main Dial, and cross keys.

QuickSteps USING MENUS

■ To display the menu when the camera is on, press the MENU button to the left of the monitor. The menu's tab bar is highlighted, or if you have previously used a command in this session, that command is highlighted.

■ To move among the four tabbed pages press JUMP one or more times.

(You can also select a tab by turning the Main Dial or pressing the up (▲) or down (▼) cross key to highlight the tab bar, then pressing the left (◀) or right (▶) cross key.)

■ To move the colored selection frame to highlight commands, turn the Main Dial or press the up (▲) or down (▼) cross key.

■ To display choices for the highlighted command, press the SET button in the center of the cross keys. To select a choice (not all commands list choices), turn the Main Dial or press the up (▲) or down (▼) cross key to select it, then press SET.

■ To back up without changing a setting, press MENU, or the shutter button before pressing SET.

■ To return to the menu if pressing SET took you to a second screen, press MENU.

■ To hide the menu, press the MENU or shutter button.

Below are the commands you'll see and the numbers of the pages where they are discussed in this book. Which commands you see depend on the exposure mode the camera is in and which menu tab is displayed. The commands marked with a * are not available when the Mode Dial is set to a mode in the Basic Zone (page 23).

SHOOTING COMMANDS (RED)

Quality (page 20)
Red-eye On/Off (page 96)
AEB (page 42)*
WB-BKT (page 66)*
Beep (page 115)
Custom WB (page 65)*
Parameters (page 117)*

PLAYBACK COMMANDS (BLUE)

Protect (page 13)
Rotate (page 13)
Print Order (page 116)
Auto Play (page 13)
Review (page 113)
Review time (page 113)

SET-UP 1 COMMANDS (ORANGE)

Auto power off (page 113)
Auto rotate (page 113)
LCD Brightness (page 113)
Date/Time (page 113)
File numbering (page 113)
Format (page 113)

SET-UP 2 COMMANDS (ORANGE)

Language (page 113)
Video system (page 113)
Communication (page 113)
Clear all camera settings (page 113)*
Sensor clean (page 113)*
Firmware Ver (page 113)

MANAGING YOUR IMAGES

When taking photos, there are times when you want to review the images you've taken, ideally before leaving the scene. While doing so, you can zoom in to examine details, or display small thumbnails so you can quickly locate a specific image. Once you've located the image you want, you can erase, protect, rotate, or display information about it. You'll find that the images are easier to see on the monitor when the light is dim so find a shady spot or dim room for best results. In playback mode, you can press the shutter button halfway down at any time to instantly return to shooting mode.

The Playback button icon.

The Index/Reduce button icons.

The Enlarge button icon.

The Erase button icon.

QUICK DELETE

When you take a photo, it's displayed on the monitor for 2 seconds. Press the Erase button during this time to delete the image before it's saved to the CF card.

QuickSteps REVIEWING IMAGES

1. With the camera on, press the Playback button on the back of the camera to display the most recent photo.
2. Turn the Main Dial or press the (◀) or right (▶) cross key on the back of the camera to scroll through your images or use any of the procedures described in the QuickSteps box "Managing Your Images" below.
3. To resume shooting, press the shutter button halfway down.

QuickSteps MANAGING YOUR IMAGES

■ **To display 9 small thumbnails in index view**, press the Index/Reduce button. Turn the Main Dial or press the cross keys to scroll the green frame to select a specific image. To return to single-image view, press the Enlarge or Playback button.

■ **To zoom an image up to 10x**, press or hold down the Enlarge button. A small square on the screen indicates which part of the zoomed image you are viewing. Press the cross keys to scroll around the image, or turn the Main Dial to scroll to the next image displayed at the same zoom. To reduce the zoom press the Index/Reduce button, and to cancel it press the Playback button.

■ **To jump 9 or 10 images at a time**, press JUMP to display a jump bar at the bottom of the monitor. Turn the Main Dial or press the left or right cross key to jump where you want. Press JUMP again to return to scrolling image by image.

■ **To erase the image** displayed in single-image view or the one highlighted in index view, press the Erase button to the left of the monitor. Highlight *Erase* and press SET.

■ **To erase all images** on the CF card, press the Erase button to the left of the monitor (a trash can icon). Highlight *All* and press SET. When prompted to confirm the deletion, highlight *OK* and press SET again. (To interrupt image erase while it's occurring, press SET again.) Be sure to think before using this command! If you delete image files by mistake see the box "Image Recovery Software" on page 14).

CONTINUED ON NEXT PAGE ...

The protect icon.

QuickSteps MANAGING YOUR IMAGES, CONTINUED

- **To display or hide information about an image**, press the INFO button to the left of the monitor. The image and histogram are discussed on page 43. Once information is displayed you can scroll through other images. To hide information and return to your previous view, press INFO again.
- **To protect or unprotect selected images** so they won't be inadvertently erased, press MENU, highlight *Protect* on the Playback menu tab and press SET. Scroll through your saved images and press SET to protect or unprotect any image. (Protected images are marked with a key-like icon in a box at the bottom of the screen.) When finished, press MENU or the shutter button.
- **To rotate selected images**, press MENU, highlight *Rotate* on the Playback menu tab and press SET. Scroll through the images and press SET one or more times to rotate any image. When finished, press MENU or the shutter button.
- **To give a slide show** on the camera's monitor or TV (see "Giving a Slide Show On TV" box below), press MENU, highlight *Auto Play* on the Playback menu tab and press SET. Each picture on the CF card is displayed for 3 seconds. To pause and restart, press SET. When paused, a pause icon is displayed in the upper left corner of the image. At any point in the show you can turn the Main Dial or press the left or right cross key to manually scroll through images. To stop the show at any point, press the MENU or shutter button. You can press INFO during a show to display or hide information about each image.
- **To create a print order**, see page 116.
- **To turn image review off or back on or change the review time** see page 113.

QuickSteps GIVING A SLIDE SHOW ON TV

To show your images on the TV, turn both the TV and the camera off while you connect the supplied video cable to the VIDEO OUT terminal on the camera and the VIDEO IN jack on the TV. Turn on the TV and set it for video input. Turn on the camera and set it to *Auto Play* as described above. Auto power off does not operate in auto play mode and the show loops over and over again. Be sure to end the show and turn off the camera when finished.

TIPS

- When looking for pictures to erase, protect, or rotate, it's often faster if you press the Index/Enlarge button to do so in index display.
- Protecting the images you want to keep and then using the *Erase*, *All* command to delete the others is a quick way to clean your CF card of unwanted images.
- When protecting or rotating images, you can use the jump command (page 14).
- You can connect the camera to a TV set (page 14) so you and others can immediately see photos as you take them. This is a great way to take portraits and close-ups.

IMAGE RECOVERY SOFTWARE

If you delete images by mistake, don't despair. There is software that will let you recover them if you don't first save other photos on the same card.

- PhotoRescue (http://www.datarescue.com/photorescue/).
- File Rescue http://www.softwareshelf.com).
- Image Rescue (http://www.lexarmedia.com).
- Image Recall (http://www.imagerecall.com)
- EasyRecovery (http://www.ontrack.com).

Selecting Image Quality and Size

Digital photographs are made up of hundreds of thousands or millions of tiny squares called *picture elements*—or just *pixels*. Like the impressionists who painted wonderful scenes with small dabs of paint, your computer and printer can use these tiny pixels to display or print photographs. To do so, the computer divides the screen or printed page into a grid of pixels. It then uses the values stored in the digital photograph to specify the brightness and color of each pixel in this grid—a form of painting by number. Controlling, or addressing a grid of individual pixels in this way is called bit mapping and digital images are called *bit-maps*.

Any image that looks sharp and with smooth transitions in tones (top) is actually made up of millions of individual square pixels (bottom). Each pixel is a solid, uniform color.

Number of Pixels

The quality of a digital image depends in part on the number of pixels used to create the image (sometimes referred to as *resolution*). At a given size, more pixels add detail and sharpen edges.

If you enlarge any digital image enough, the pixels will begin to show—an effect called *pixelization*. This is not unlike traditional silver-based prints where grain begins to show when prints are enlarged past a certain point.

When a digital image is displayed or printed at the correct size for the number of pixels it contains, it looks like a normal photograph. When enlarged too much (as is the eye here), its square pixels begin to show. Each pixel is a small square made up of a single color.

The size of a photograph is specified in one of two ways—by its dimensions in pixels or by the total number of pixels it contains. For example, the same image can be said to have 3072 × 2048 pixels (where "×" is pronounced "by" as in "3072 by 2048"), or to contain 6.3 million pixels or megapixels (3072 multiplied by 2048).

Image sizes are expressed as dimensions in pixels (3072 × 2048) or by the total number of pixels (6.3 megapixels).

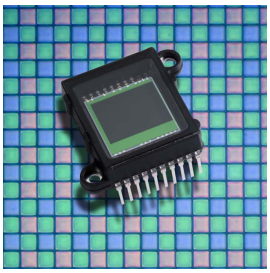
DIGITAL REBEL IMAGE SIZES

The Digital Rebel gives you a choice of three image sizes: 3072 × 2048 (large), 2048 x 1360 (medium), and 1536 × 1024 (small).

HOW AN IMAGE IS CAPTURED

Digital cameras are very much like the still more familiar 35mm film cameras. Both types contain a lens, an aperture, and a shutter. The lens brings light from the scene into focus inside the camera so it can expose an image. The aperture is a hole that can be made smaller or larger to control the amount of light entering the camera. The shutter is a device that can be opened or closed to control the length of time the light is allowed to enter.

This cutaway view shows the inside of the camera including the mirror that swings up out of the way when you take a picture.



An image sensor sits against a background enlargement of its square pixels, each capable of capturing one pixel in the final image. Courtesy of IBM.

The big difference between traditional film cameras and digital cameras is how they capture the image. Instead of film, digital cameras use a solid-state device called an *image sensor*. In the Digital Rebel, the image sensor is a CMOS chip. On the surface of this fingernail-sized silicon chip is a grid containing over 6 million photosensitive diodes called *photosites*, *photoelements*, or *pixels*. Each photosite captures a single pixel in the photograph to be.

THE EXPOSURE

When you press the shutter button of a digital camera, a metering cell measures the light coming through the lens and sets the aperture and shutter speed for the correct exposure. When the shutter opens briefly, each pixel on the image sensor records the brightness of the light that falls on it by accumulating an electrical charge. The more light that hits a pixel, the higher the charge it records. Pixels capturing light from highlights in the scene will have high charges. Those capturing light from shadows will have low charges.

When the shutter closes to end the exposure, the charge from each pixel is measured and converted into a digital number. This series of numbers is then used to reconstruct the image by setting the color and brightness of matching pixels on the screen or printed page.

IT'S ALL BLACK AND WHITE AFTER ALL

It may be surprising, but pixels on an image sensor can only capture brightness, not color. They record only the *gray scale*—a series of tones ranging from pure white to pure black. How the camera creates a color image from the brightness recorded by each pixel is an interesting story.

The gray scale contains a range of tones from pure white to pure black.

PARAMETERS

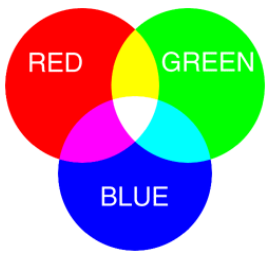
In JPEG modes the camera uses 8 bits to store brightness levels. This means it can store 2^8 or 256 levels. In RAW mode, it uses 16 bits. This means it can store 2^{16} or 65,536 levels.

FROM BLACK & WHITE TO COLOR

When photography was first invented, it could only record black and white images. The search for color was a long and arduous process, and a lot of hand coloring went on in the interim (causing one photographer to comment "so you have to know how to paint after all!"). One major breakthrough was James Clerk Maxwell's 1860 discovery that color photographs could be created using black and white film and red, blue, and green filters. He had the photographer Thomas Sutton photograph a tartan ribbon three times, each time with a different color filter over the lens. The three black and white images were then projected onto a screen with three different projectors, each equipped with the same color filter used to take the image being projected. When brought into alignment, the three images formed a full-color photograph. Over a century later, image sensors work much the same way.

Colors in a photographic image are usually based on the three primary colors red, green, and blue (RGB). This is called the *additive color system* because when the three colors are combined or added in equal quantities, they form white. This RGB system is used whenever light is projected to form colors as it is on the display monitor (or in your eye).

Since daylight is made up of red, green, and blue light; placing red, green, and blue filters over individual pixels on the image sensor can create color images just as they did for Maxwell in 1860. Using a process called *interpolation*, the camera computes the full color of each pixel by combining the color it captured directly with the other two colors captured by the pixels around it.



RGB uses additive colors. When all three are mixed in equal amounts they form white. When red and green overlap they form yellow, and so on.

CHOOSING IMAGE SIZE, FORMAT AND COMPRESSION

The size of an image file and the quality of the picture it contains depends in part on the number of pixels in the image and the amount of compression used to store it. The Digital Rebel lets you choose from three image sizes and two compression ratios as a way of controlling the size of image files. Because you can squeeze more 1536 x 1024 images onto a storage device than you can squeeze 3072 x 2048 images, there may be times when you'll want to switch to the smaller size and sacrifice quality for quantity.

Images are normally stored in a format called JPEG after its developer, the Joint Photographic Experts Group and pronounced "jay-peg." This file format not only compresses images, it also allows you to specify how much they are compressed. This is a useful feature because there is a trade-off between compression and image quality. Images in the Fine mode are compressed less than those in the Normal mode. Less compression gives you better images so you can make larger prints, but you can't store as many images.

PARAMETERS

You can store three different sets of contrast, sharpness, saturation, and color tone settings and then select any one of the sets for scenes you photograph (page 117).

With the Digital Rebel in Creative Zone modes (page 23) you can choose between the common JPEG file format and the higher-quality RAW file format (.crw). RAW images are stored in an unprocessed format so they can later be processed on your more powerful desktop computer. These RAW files are stored in the camera using a lossless compression scheme that preserves every bit of the captured data. These files are quite large, even when compressed, so you can't store as many but they contain all of the tones, colors, and details captured by the camera. RAW files are 3072 X 2048 pixels and can be viewed with the File Viewer Utility software included on the CD that comes with the camera. Using this software you can convert RAW files to TIFF or JPEG files and adjust their exposure compensation, white balance, contrast, color saturation, tone, sharpness, and color space. RAW files also contain a 2048 x 1360 JPEG image that you can extract with the software. This gives you an identical high quality RAW file and a smaller, more easily distributable JPEG image file.

RAW images are initially captured by the sensor in 48 bit full color RGB (16 bits per channel) but are reduced to 24 bit RGB (8 bits per channel) when converted into JPEG files. The full 48 bits are retained in the RAW file format until the images are processed on your computer. Even then, all 16 bits for each color can be retained when you save the image as a TIFF file.

Image sizes are indicated by letters L, M, and S (large, medium, and small). Compression modes are indicated with pie-slice-like icons. Fine mode has a smooth edge and Normal mode has a rough stair-step edge.

As you change quality settings, you're also affecting how many images can be stored in your camera. The larger the size or the less the compression, the fewer you can store. Sometimes when there is no storage space left, you can switch to a smaller size and poorer quality and squeeze a few more images onto the CF card. The list below gives the sizes/compression ratios from which you can choose. The approximate size of each image file is given in parentheses, followed by the approximate number of images that you can store on a 128MB CF card. The exact file size varies somewhat and depends on both the subject matter, ISO setting, and parameters being used.

- Large/Fine have 3072 X 2048 pixels (3.1MB, 38)
- Large/Normal have 3072 X 2048 pixels (1.8MB, 65)
- Medium/Fine have 2048 x 1360 pixels (1.8MB, 66)
- Medium/Normal have 2048 x 1360 pixels (1.2MB, 101)
- Small/Fine have 1536 X 1024 pixels (1.4MB, 88)
- Small/Normal have 1536 X 1024 pixels (0.9MB, 132)
- RAW with lossless compression have 3072 X 2048 pixels (7MB, 16)

The Digital Rebel allows you to have two different resolution/compression settings in use at the same time:

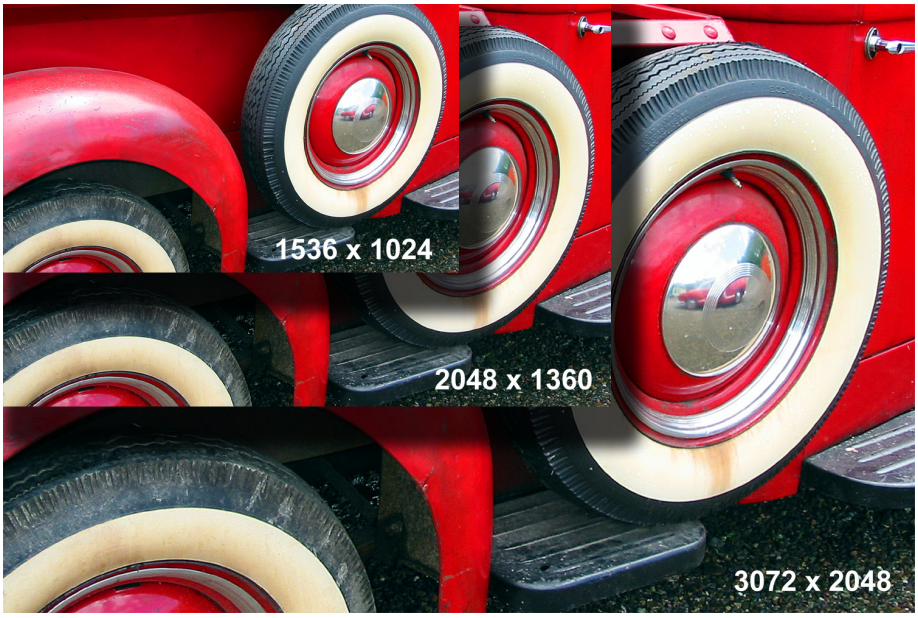
- Basic Zone modes are treated as a group. A change in any of these modes changes all of them. If you switch to any Creative Zone mode, the settings change to that zone's settings.
- Creative Zone modes are treated as a group. A change in any of these modes affects all of them. If you switch to any Basic Zone mode, the settings change to that zone's settings.

The number of images remaining at the current quality setting is displayed on the LCD panel.

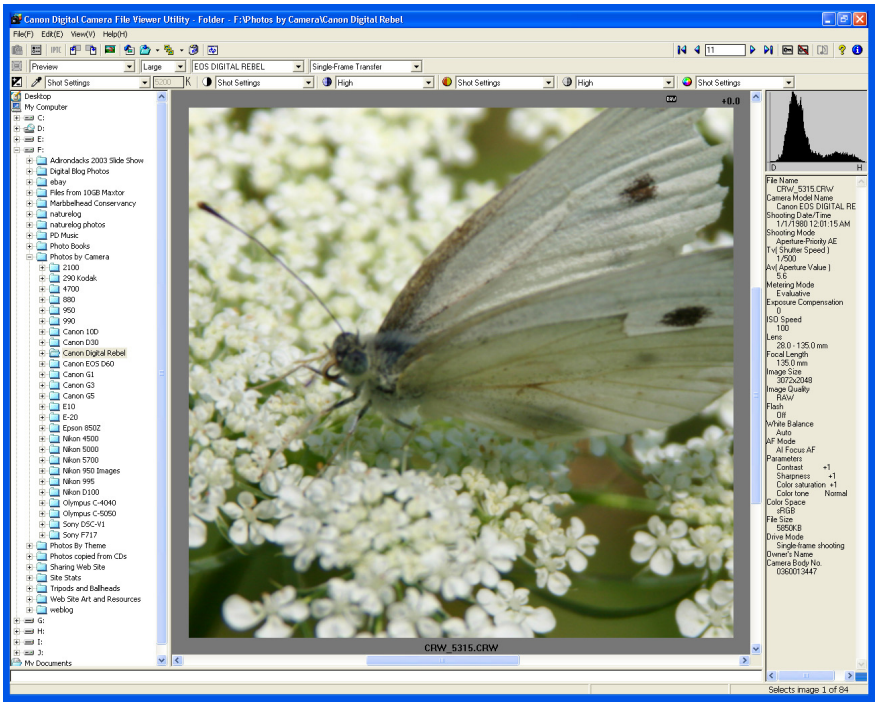
QuickSteps SELECTING IMAGE QUALITY

1. With the Mode Dial set to any mode (or to any mode in the Creative Zone if selecting RAW), press MENU and display the Shooting menu tab. (The Creative Zone is discussed on page 23.)
2. Highlight *Quality* and press SET to display a list of quality choices.
3. Highlight one of the choices and press SET to select it. (RAW mode is only displayed when the camera is set to one of the Creative Zone modes.)
4. Press the MENU or shutter button to hide the menu.

Here are the relative sizes of the Digital Rebel's images. The smallest size is best for the Web and e-mail and the largest for prints.



The File Viewer Utility converts RAW files to TIFF format and extracts JPEG images.



Chapter 2
Controlling Exposure

CONTENTS

■ Understanding Exposure ■ Choosing Exposure Modes ■ Using Image Zone Modes ■ Using Program AE ■ Using Shutter-Priority (Tv) Mode ■ Using Aperture Priority (Av) Mode ■ Using Manual Mode ■ How Your Exposure System Works ■ How Exposure Affects your Images ■ When Automatic Exposure Works Well ■ When to Override Automatic Exposure ■ How to Override Automatic Exposure ■ Understanding Histograms

Automatic exposure control is one of your camera's most useful features. It's great to have the camera automatically deal with the exposure while you concentrate on the image. This is especially helpful when photographing action scenes where there isn't time to evaluate the situation and manually set the controls.

You shouldn't, however, always leave the exposure to the automatic system. At times the lighting can fool any automatic exposure system into producing an underexposed (too dark) or overexposed (too light) image. Although you can make adjustments to a poorly exposed image in a photo-editing program, you've lost image information in the shadows or highlights that can't be recovered. You will find it better in some situations to override the automatic exposure system at the time you take the picture.

Typical situations in which you might want to override automatic exposure include scenes with interesting and unusual lighting. For example, you need to take control when you photograph into the sun, record a colorful sunset, show the brilliance of a snow-covered landscape, or convey the dark moodiness of a forest.

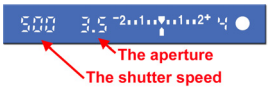
UNDERSTANDING EXPOSURE

AN ANALOGY

One way to think of shutter speeds and apertures is as faucets. You can fill (expose) a bucket with a small faucet opening (aperture) over a long time (shutter speed), or a large faucet opening in a shorter period. No matter which combination you choose, the bucket can be filled the same amount.

The most creative controls you have with any camera are the shutter speed and aperture settings. Both affect the exposure, the total amount of light reaching the image sensor, and so control how light or dark a picture is. The shutter speed controls the length of time the image sensor is exposed to light and the aperture controls the brightness of that light. You, or the camera's autoexposure system, can pair a fast shutter speed (to let in light for a short time) with a large aperture (to let in bright light) or a slow shutter speed (long time) with a small aperture (dim light). When you let in just the right amount of light, the exposure is perfect. But perfect for what part of the scene? Every scene has parts that are dark, bright, and every tone in between. To capture an image the way you want to interpret it, you select the most important part of the scene and decide what tone you want this area to have in the final image. You then expose the image so that tone appears as light or dark as you want. Since autoexposure will make it middle gray (page 31), you may have to change the exposure to make it lighter or darker. You do this by changing the shutter speed or aperture.

Speaking of exposure only, it doesn't make any difference which combination of shutter speed and aperture is used. But in other ways, it does make a difference, and it is just this difference that gives you some creative opportunities. Whether you know it or not, you're always balancing camera or subject movement against depth of field (page 52) because a change in one causes a change in the other. Let's see why.



When you press the shutter button halfway down and the exposure is set, the shutter speed and aperture being used are displayed on the LCD panel and monitor.

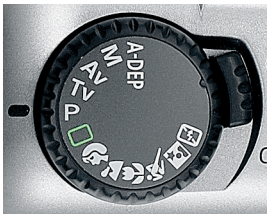
Shutter speeds and apertures each have a standard series of settings called "*stops*." With shutter speeds, each stop is a second or more, or a fraction of a second indicating how long the shutter is open. Apertures are given as f/stops that indicate the size of the lens opening through which light enters the camera. The stops are arranged so that a change of 1 full stop lets in half or twice the light of the next setting. A shutter speed of 1/60 second lets in half the light that 1/30 second does, and twice the light of 1/125 second. An aperture of f/8 lets in half the light that f/5.6 does, and twice the light of f/11. If you make the shutter speed 1 stop slower (letting in 1 stop more light), and an aperture 1 full stop smaller (letting in 1 stop less light), the exposure doesn't change. (This is exactly how the program shift mode discussed on page 25 works.) However, you increase the depth of field slightly and also the possibility of blur.

- For fast-moving subjects you need a fast shutter speed (although the focal length of the lens you are using, the closeness of the subject, and the direction in which it's moving also affect how motion is portrayed).

- For maximum depth of field, with the entire scene sharp from near to far, you need a small aperture (although the focal length of the lens and the distance to the subject also affect depth of field).

Here the middle image was shot at the suggested exposure. The shots on either side were exposed one or two stops under and over the suggested reading to lighten or darken the image.

CHOOSING EXPOSURE MODES



The Mode Dial indicates Basic Zone modes with icons and Creative Zone modes with letters.

Full Auto icon.

Your Digital Rebel offers various levels of control. All modes give equally good results in the vast majority of photographic situations. However, when you photograph in specific situations, these alternate exposure modes have certain advantages.

The many shooting modes are divided into two types, or zones—Basic Zone and Creative Zone. Each zone has a number of modes you can choose with the Mode Dial on top of the camera. Basic Zone modes, including Full Auto and six Image Zones, are indicated with picture-like icons and Creative Zone modes with text (P, Tv, Av, M, and A-DEP). Let's take a look at these two zones and the modes they include.

Basic Zone modes include Full Auto, which we've already discussed (page 8), and six Image Zone modes designed for specific situations. These modes include Portrait, Landscape, Close-up, Sports, Night Portrait and Flash Off. These modes are discussed in detail on page 24.

Creative Zone modes give you more control of shutter speed, aperture, and other important color, ISO, and exposure settings for creative effects.

- **P** (Program AE) is like Full Auto, but you can easily select different pairs of aperture/shutter speed settings to emphasis depth of field or motion (page 25).
- **Tv** (shutter-priority) lets you choose the shutter speed, while the camera automatically sets the aperture to give you a good exposure. You select this mode when the portrayal of motion is most important. It lets you set your shutter speed fast enough to freeze the action or slow enough to blur it (page 26).
- **Av** (aperture-priority) lets you select the aperture (lens opening) while the camera automatically sets the shutter speed to give you a good exposure. You select this mode whenever depth of field is most important. To be sure everything is sharp, as in a landscape, select a small aperture. To throw the background out of focus so a main subject such as a portrait stands out, select a large aperture (page 28).
- **M** (manual) lets you choose both the shutter speed and aperture so you can get just the setting you want. Most photographers select this mode only when other modes won't give them the results they want (page 30).
- **A-DEP** (Auto Depth-of-field Priority) evaluates all of the focus points in the viewfinder and selects an aperture that will give enough depth of field to keep all of them in focus (page 58).

Knowing how to use these various modes gives you amazing creative control over your images. Because these are the most important controls in your creative arsenal, we'll look at them in depth in the pages that follow.

TIPS

- In some situations, your pictures can be too light or too dark in any exposure mode. To darken or lighten them, use exposure compensation (page 41).
- Check the shutter speed and aperture in the viewfinder when you press the shutter button halfway down. If either is blinking, the camera doesn't have the right exposure setting. To see how to adjust it, read the sections that follow.

QuickSteps CHANGING EXPOSURE MODES

1. Set the power switch to *ON*.
2. Turn the Mode Dial to any setting so it aligns with the small black marker on the camera body.

USING IMAGE ZONE MODES

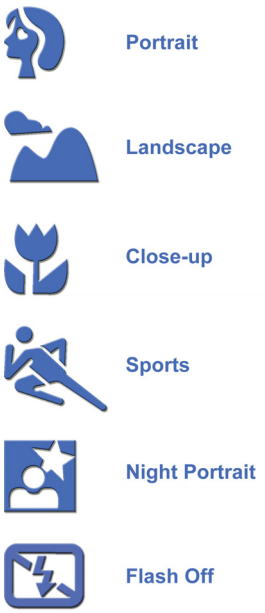


Image Zone icons.

The Mode Dial has a number of Image Zone modes designed for use in specific situations. All of these modes work just like Full Auto, but draw on a library of settings designed for specific situations. For example, in Portrait mode the camera will select settings for a shallow depth of field so the background is softer. In Landscape mode, it will do the opposite and select a small aperture to give you as much depth of field as possible. (For more on the concepts of depth of field, see Chapter 3.)

In all Image Zone modes except manual (M), the metering mode is set to evaluative (page 33). All modes but Sports and Portrait set the drive mode to single-frame (page 112), and all modes other than Sports set autofocus to One-Shot (page 54). ISO (page 48) varies between 100–400 in all modes other than Portrait where it's fixed at 100 and Sports where it's fixed at 400.

■ **Portrait** sets the camera for minimum depth of field so a portrait will have a soft, and less distracting, background. To maximize the effect, zoom in on the subject, use a long lens so the subject fills most of the viewfinder, and make sure there is as much distance as possible between the main subject and the background. Drive is set to continuous (page 112).

■ **Landscape** sets the camera for maximum depth of field so everything is sharp from foreground to background. Since a slow shutter speed may be used in this mode, you may need to support the camera (page 47). This mode works best with a short focal length (wide-angle) lens and the built-in flash doesn't fire in this mode.

■ **Close-up** is used to capture flowers and other small objects but isn't a substitute for a macro lens (page 105). This mode works best when focused on subjects at the lens' minimum focusing distance.

■ **Sports** mode is ideal for action sports and other fast-moving subjects. The autofocus mode is automatically set to AI Servo (page 54) to keep a moving subject in focus. The drive mode is set to continuous (page 112) so you can take pictures one after another as long as you hold down the shutter button. The built-in flash doesn't fire in this mode. For best results use a long focal length lens (page 86).

■ **Night Portrait** is designed for photographing people or other nearby subjects at twilight, night, or dawn. The flash illuminates foreground subjects and the shutter speed is set slow enough to lighten the background. Since a slow shutter speed may be used, you may need to support the camera (page 47). When taking a picture, be sure to hold the camera still until the shutter closes; don't move it just because the flash fires. Also, if people are in the foreground, ask them to freeze until a few seconds after the flash has fired. In daylight, this mode operates just like Full Auto.

■ **Flash Off** disables the built-in flash or any external Speedlite flash when you don't want it to fire. The AF mode is set to AI Focus (page 54), and both ISO speed and white balance are set automatically.

TIP

In some situations your pictures can be too light or too dark in any exposure mode. To darken or lighten them, switch to a mode in the Creative Zone and use exposure compensation (page 41).

QuickSteps USING IMAGE ZONE MODES

■ Turn the power switch to *ON* and turn the Mode Dial to any Image Zone icon so it aligns with the small black marker.

USING PROGRAM AE AND PROGRAM SHIFT

TIP

If the shutter speed indicator in the viewfinder is blinking *30″*, the image will be too dark. Use flash (page 93) or a higher ISO (page 48). If *4000* is blinking, the image will be too light. Use a neutral density filter (page 89) or lower the ISO.

In Full Auto mode (page 8), your camera is automatically set to produce the best possible exposure. Program AE (P) mode is also fully automatic, but it lets you change more settings including all of those available in other Creative Zone modes.

QuickSteps USING PROGRAM AE (P) MODE

1. Set the power switch to *ON*.
2. Set the Mode Dial to P (for Program AE).

One unique feature of Program AE mode is called *program shift*. This feature lets you cycle through a series of aperture/shutter speed combinations that offer identical exposures. By choosing the right combination you can choose to emphasize depth of field (page 28) or motion capture (page 26). If you are using flash, you cannot shift the program.

QuickSteps USING PROGRAM SHIFT

1. Set the power switch to *ON* and close the flash.
2. With the Mode Dial set to P (for Program AE), press the shutter button halfway down, and then release it to activate the displays.
3. Turn the Main Dial to scroll through aperture/shutter speed combinations in the viewfinder and on the LCD panel until you find the combination you want to use.
4. Press the shutter button all the way down to take the photo. The shifted program setting is cancelled automatically if you pause a few seconds after the picture is taken before taking another one. If you take another picture immediately, you use the shifted settings. You can also hold the shutter button halfway down to keep the shifted setting from changing.

Program AE mode is so flexible it gives you the control you need for creative images.

USING SHUTTER-PRIORITY (TV) MODE

TIP

If you can't get a fast enough shutter speed, try increasing the camera's ISO (page 48).

The shutter keeps light out of the camera except during an exposure, when it opens to let light strike the image sensor. The length of time the shutter is open affects both the exposure of the image and how motion is portrayed in it.

The Digital Rebel has two shutter curtains that run vertically. When you take a photo the first curtain opens to begin the exposure, then the second curtain closes to end it. The time between the first and second curtains depends on the shutter speed or time value (Tv).

At very short time values, the second curtain will start to close the shutter before the first curtain is completely open; there is effectively a "slit" opening which travels across the image sensor.

Slower shutter speeds let more light strike the image sensor so an image is lighter. Faster shutter speeds let less strike it so the image is darker. The reason you don't see the change is because when you change the shutter speed in this mode, the camera changes the aperture to keep the exposure constant.

In these pictures, the shutter was left open longer for the image on the right than for the one on the left. It's this longer exposure time that has made the image lighter.

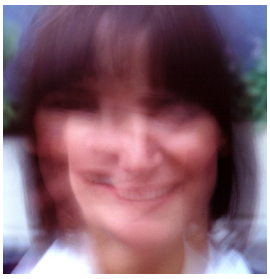
Shooting down from an upper level at the Guggenheim Museum, a very slow shutter speed froze the people standing, and blurred those who were walking.

THE WAY IT WAS: EARLY SHUTTER DESIGNS

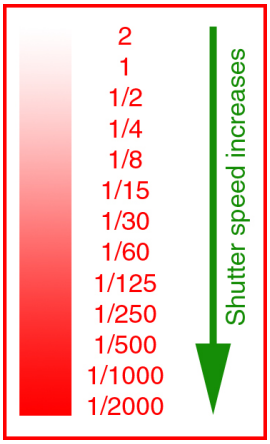
The shutter, used to control the amount of time that light exposes the image sensor, has changed considerably over the years. The earliest cameras, using film that might take minutes to be properly exposed, came with a lens cap that the photographer removed to begin the exposure and then replaced to end it. As film became more sensitive to light and exposure times became shorter, faster shutters were needed. One kind used a swinging plate while another design used a guillotine-like blade. As the blade moved past the lens opening, a hole in the blade allowed light to briefly reach the film.

In addition to controlling exposure (the amount of light that reaches the image sensor), the shutter speed is the most important control you have over how motion is portrayed in a photograph. Understanding shutter speeds is vital if you want to anticipate if a moving subject will appear in your image sharp or blurred. The longer the shutter is open, the more a moving subject

A fast shutter speed (left) opens and closes the shutter so quickly a moving subject doesn't move very far during the exposure, a slow speed (right) allows moving objects to move sufficiently to blur their image on the image sensor.



Katie turned a little just as the shutter opened causing unwanted blur in the image.



Here is how the camera will display 1/2 second (top), 2 seconds (middle), and 2.5 seconds (bottom).

will be blurred in the picture. Also, the longer it's open the more likely you are to cause blur by moving the camera deliberately or not. The Digital Rebel's shutter-priority (Tv) mode is designed to give you control over shutter speeds so you can have control over the way motion is captured in your images.

Although digital cameras can select any fraction of a second for an exposure, there are a series of settings that have traditionally been used (shown in the illustration to the left). These shutter speed settings are arranged in a sequence so that each setting lets in half as much light as the next slowest setting and twice as much as the next fastest. Each of these settings is called a "stop" and with the Digital Rebel you can select any shutter speed from a slow 30 seconds to a fast 1/4000 in one-third stop increments. There is even a bulb setting available in manual (M) mode that keeps the shutter open as long as you hold down the shutter button (page 73).

- Shutter speeds faster than 1 second are actually fractions of a second, but only the denominator is displayed. For example, when the shutter speed is 1/4 second, it is displayed as 2.

- Shutter speeds of 1 second or slower are displayed with quotation marks. For example when the shutter speed is 2 seconds, it's displayed as 2". When the shutter speed is 2.5 seconds, it's displayed as 2"5.

QuickSteps USING SHUTTER-PRIORITY (TV) MODE

1. With the Mode Dial set to Tv (time value or shutter-priority) press the shutter button halfway down and then release it to activate the displays.
2. Turn the Main Dial to select a shutter speed as you watch the viewfinder or LCD panel. If the aperture value isn't blinking, the exposure is OK. However;
   - If the smallest aperture value (largest aperture) blinks, the image may be too dark so turn the Main Dial to select a slower shutter speed.
   - If the largest aperture value (smallest aperture) blinks, the image may be too light so turn the Main Dial to select a faster shutter speed.
3. Press the shutter button all the way down to take the picture.

USING APERTURE-PRIORITY (AV) MODE

The aperture diaphragm, a ring of overlapping leaves within the camera lens, adjusts the size of the opening through which light passes to the image sensor. As the aperture changes size, it affects both the exposure of the image and the depth of field that determines what is sharp from foreground to background.

The aperture can be opened up to let in more light or closed or "stopped" down to let in less. Like the shutter speed, the aperture is used to control exposure. The larger the aperture opening, the more light reaches the image sensor in a given period of time. The more light, the lighter the image. The reason you don't see the change is because when you change the aperture in this mode, the camera changes the shutter speed to keep the exposure constant.

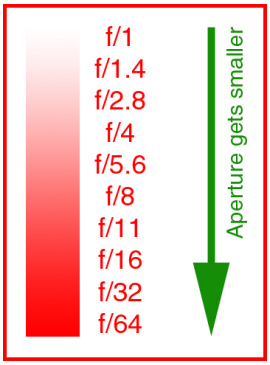
THE WAY IT WAS: EARLY APERTURES

A variety of designs over the history of photography have enabled photographers to change the size of the lens opening. A form of the iris diaphragm, used in today's cameras, was used as early as the 1820s by Joseph Nicephore Niepce, one of the inventors of photography. Waterhouse stops, used in the 1850s were a series of blackened metal plates with holes of different sizes cut in them. To change apertures the photographer chose the appropriate plate and slid it into a slot in the lens barrel. With wheel stops, different size apertures were cut into a revolving plate. The photographer changed the size of the aperture by rotating the plate to align the desired opening with the lens.

Like shutter speed, aperture also affects the sharpness of your picture, but in a different way. Changing the aperture changes the *depth of field*, the depth in a scene from foreground to background that will be sharp in a photograph. The smaller the aperture you use, the deeper the area of a scene that will be sharp. For some pictures—for example, a landscape—you may want a smaller aperture for maximum depth of field so that everything from near foreground to distant background is sharp. But in a portrait you may want a larger aperture to decrease the depth of field so your subject's face is sharp but the background is soft and out of focus.

Shallow depth of field can make part of an image stand out sharply against a softer background. This emphasizes the sharpest part of the image.

Great depth of field keeps everything sharp from the foreground to the background.



The Digital Rebel's Av (aperture-value) mode lets you select aperture settings so you have control over the way depth of field is captured in your images. Aperture settings, called *f/stops*, indicate the size of the aperture opening inside the lens. Each full f/stop lets in half as much light as the next larger opening and twice as much light as the next smaller opening. The range of the Digital Rebel's f-stops depends on the lens you are using.

Notice that as the f/stop number gets larger (f/4 to f/11, for example), the aperture size gets smaller. This may be easier to remember if you think of an f-number as a fraction (which it really is): 1/11 is less than 1/4, just as the size of the f/11 lens opening is smaller that the size of the f/4 opening.

How wide you can open the aperture, referred to as its "speed," depends on the chosen len's *maximum aperture* (its widest opening). The term "fast lens" usually applies to lenses that can be opened to a wide maximum aperture for their focal length (page 83). Faster lenses are better when photographing in dim light or fast moving subjects.

QuickSteps USING APERTURE-PRIORITY (Av) MODE

1. With the Mode Dial set to Av (aperture value), press the shutter button halfway down and then release it to activate the displays.
2. Turn the Main Dial to select an aperture as you watch the viewfinder or LCD panel. If the shutter speed isn't blinking, the exposure is OK. However;
   - If the *30"* shutter speed blinks, the image may be too dark so turn the Main Dial to select a larger aperture.
   - If the *4000* shutter speed blinks, the image may be too light so turn the Main Dial to select a smaller aperture.
3. Press the shutter button all the way down to take the picture.

TIPS

- To check depth-of-field in the viewfinder when using Creative Zone modes, press the depth-of-field preview button (page 57).
- If you can't get a small enough aperture, try increasing the camera's ISO (page 48).
- When selecting an aperture, the viewfinder's information display isn't turned on until you press the shutter button halfway down. After doing so, you can then release the shutter button while selecting an aperture.

USING MANUAL MODE

TIPS

- When changing settings, the viewfinder's information display isn't turned on until you press the shutter button halfway down. After doing so, you can then release it while selecting settings.
- In manual (M) mode, metering is automatically set to center-weighted (page 33).

When you want total and absolute control over exposures, you can switch to manual (M) exposure mode. In this mode, you manually select both the shutter speed and aperture setting. Since automatic exposure combined with exposure compensation (page 41) is so easy to use, most photographer's only resort to manual mode in those rare situations where other modes can't give them the results they want.

When you press the shutter button halfway down in manual (M) mode, an exposure scale shows you how much you are under (-) or over (+) exposed. If the indicator is under the -2 or +2 and flashing it means you are off by more than two stops.

Manual mode is often used when doing studio-like shots where you know the right exposure for the main subject but want to try variations on the background.

QuickSteps USING MANUAL (M) MODE

1. With the Mode Dial set to M (manual), press the shutter button halfway down and then release it to activate the exposure scale that shows how much you are over or under the recommended exposure.
2. As you watch the viewfinder or LCD panel, turn the Main Dial by itself to select a shutter speed and while holding down the Av/ Exposure Compensation button to select an aperture.
3. If the marker below the scale is centered (0), you're right on.
   - If the indicator is on the minus (-) side of the scale, you are under-exposing and darkening the image. To lighten it, select a slower shutter speed or larger aperture.
   - If the indicator is on the plus side (+) you are overexposing and lightening the image. To darken it, select a faster shutter speed or smaller aperture.
4. Press the shutter button all the way down to take the picture.

The Av/Exposure compensation button icon.

The exposure scale.

How Your Exposure System Works

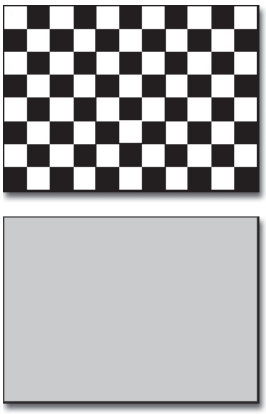
All exposure systems, including the one built into your digital camera, operate on the same general principles. A light-sensitive photocell regulates the amount of electricity flowing in the exposure system. As the intensity of the light reflected from the subject changes, the amount of electricity flowing through the photocell's circuits changes. These changes are then used by the autoexposure system to calculate and set the shutter speed and aperture.

Your camera's meter measures light reflecting from the part of the scene shown in the viewfinder. The coverage of the meter (the amount of the scene that it includes in its reading) changes, just as your viewfinder image changes, when you change your distance relative to the scene or when you change the focal length of the lens. Suppose you move close or zoom in and see in your viewfinder only a detail in the scene, one that is darker or lighter than other objects nearby. The suggested aperture and shutter speed settings will be different for the detail than they are for the overall scene.

METER AVERAGING AND MIDDLE GRAY

Your exposure meter doesn't "see" a scene the same way you see it. Its view is much like yours would be if you were looking through a piece of frosted glass.

Your meter sees scenes as if it were looking at them through a piece of frosted glass. It doesn't see details, just averages.



Where you see a black and white checkerboard (top), your camera sees only an average gray (bottom).

Every scene you photograph is something like a checkerboard (left), but even more complex. Portions of it are pure black, pure white, and every possible tone in between. Regardless of the elements making up the scene, your camera's meter can average and measure brightness only.

The exposure meter and exposure control system can't think. They do exactly what they are designed to do and they are designed to do only one thing. Regardless of the scene, its subject matter, color, brightness, or composition, the meter measures the overall amount of light reflecting from the scene. Since the light meter measures only brightness (how light or dark the scene is) and not color, the automatic exposure system then calculates and sets the

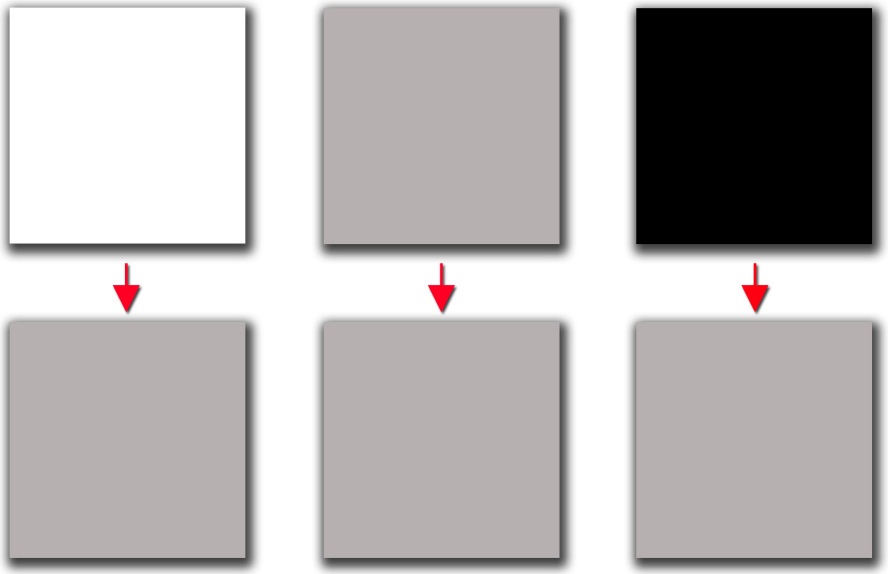
aperture and the shutter speed to render this level of light as "middle gray" in the photograph. Most of the time this works very well because most scenes have an overall reflectance that averages out to middle gray. But some scenes and situations don't average out to middle gray and that's when autoexposure will lead you astray.

A continuous spectrum of tones, ranging from pure black at one end to pure white at the other is contained in most scenes. In simple terms, this continuous scale can be thought of as being divided into a series of individual tones called a gray scale. Each of the tones in this scale has received 1 stop more exposure than the next darkest tone in the series, and one stop less exposure than the next lightest tone. The tone in the middle is called *middle gray* and reflects exactly 18% of the light falling on it.

The gray scale is a series of steps reflecting different levels of brightness.

When you photograph a subject, your camera's autoexposure system will set an exposure so that the subject will appear in the final image as middle gray regardless of its actual brightness. When you photograph subjects that have an overall tone lighter or darker than middle gray, they will be middle gray in the final image and therefore look too light or dark. For example, if you photograph a white card, a gray card, and a black card, and each completely fills the viewfinder when the exposure is calculated, each of the cards will be middle gray in the captured image.

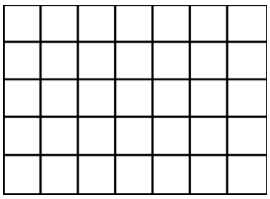
White, gray, and black cards will all photograph as gray cards.



To make scenes that don't average out to middle gray appear in an image the way they appear in real life, you have to use exposure compensation (page 41) or some other form of exposure control to lighten or darken the picture.

TYPES OF METERING

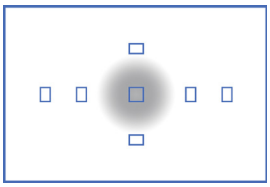
All parts of a scene are usually not equally important when determining the best exposure to use. In a landscape, for instance, the exposure of the foreground is usually more important than the exposure of the sky. For this reason, the Digital Rebel uses various metering methods depending on



The 7 x 5 grid used in evaluative metering.

circumstances. You can't choose a metering mode directly, but you can choose one other than evaluative indirectly by using AE (exposure) lock or manual (M) exposure mode.

■ **Evaluative metering**, the mode normally used, divides the scene as seen through the viewfinder into 35 zones, each of which is linked to the focus points. Each of the 35 zones is the same size and they are laid out in a 7 x 5 matrix. When using autofocus, the metering system gives special emphasis to the subject you're focused on at the active focus point. This mode is the default in most situations because it's ideal for general shooting conditions and backlit scenes.



The area of the viewfinder used for partial metering occupies on the central 9%.

■ **Partial metering**, used in Creative Zone modes when you use AE lock (page 41), meters the part of the scene falling within a circle in the center of the viewfinder. This zone covers only 9% of viewfinder area so it's almost a spot meter. This allows you to meter just a specific part of the scene instead of relying on an overall reading. This mode is ideal when photographing a subject against a very dark or very light background.

■ **Center-weighted averaging metering**, set automatically in manual (M) exposure mode (page 30), meters the entire scene but assigns the most importance to the center of the frame where the most important subjects are usually located.

Metering can cause problems if the camera isn't metering the main subject or when the main subject is very dark or light. For instance, a dark object located off center against a very light background may not be exposed properly because it is not located in the area the meter is emphasizing. These occasions are uncommon, but when they occur you can ensure accurate exposures using exposure compensation (page 41), AE Lock (page 41) and autoexposure bracketing (page 42).

In this image, automatic exposure worked well because the scene averages out to middle gray.

In this image of an ice filled harbor, automatic exposure would not have worked well because the scene is lighter than middle gray.

How Exposure Affects Your Images

When you take a photograph, the exposure isn't uniformly distributed over the sensor's surface—unless you are photographing a subject that is absolutely uniform in tone. Highlights (brighter areas) in the scene reflect the most light, and the areas of the sensor onto which they are focused are exposed a great deal. Darker areas, like shadows, reflect much less light, so the areas of the sensor onto which they are focused receive much less exposure. The perfect exposure retains details in both the highlights and shadows. For the autoexposure system, this is as difficult as your parking a very large car in a very small garage. If there is even a little too much exposure, the image is too light and details are lost in the highlights. If there is too little exposure the image is too dark and details are lost in the shadows.

One way to ensure you get the best exposure is to take three exposures. The first would be at the recommended setting. The second would be lighter and the third darker than the original one. This process is referred to as *bracketing* because you're bracketing the suggested exposure. You can do this using exposure compensation (page 41) or autoexposure bracketing (page 42).

In this series of photographs you can see the effect of exposure on the image. The top photo is correctly exposed. The bottom left photograph is overexposed and is too light. The bottom-right photo is exposed too little and is too dark.

When Automatic Exposure Works Well

Most scenes that you photograph have an overall brightness of middle gray. Some areas of the scene may reflect 90% of the light and other parts may reflect 5%, but overall the average amount of light reflecting from the scene is 18%, the amount reflected by a middle gray subject.

Whenever you photograph a normal scene with this average brightness, your automatic exposure system exposes it correctly. Typical middle gray scenes include the following:

- Scenes in bright sunlight where the subject is front-lit by a sun that is behind you when you face the scene.
- Scenes on overcast days or under diffused light, such as in the shade or in evenly-lit scenes indoors.

This image has detail in the lightest (highlight) and darkest (shadow) areas. If just a little darker or a little lighter, details would be lost in the shadows or highlights.

Portraits in indirect light generally have the tones needed to get a good image without additional exposure control.

When to Override Automatic Exposure

Let's take a look at some of the most common situations where your automatic exposure system will have problems. It's in these situations where you'll need to override the suggested exposure settings.

SCENES LIGHTER THAN MIDDLE GRAY

Scenes lighter than middle gray, such as beach scenes, or bright sand or snow covered landscapes, reflect more than 18% of the light falling on them. The autoexposure system doesn't know the scene should look bright so it calculates an exposure that produces an image that is too dark. To lighten the image so it matches the original scene, you must override the camera's automatic exposure system to add exposure.

The snow scene here is typical of scenes that are lighter than middle gray. Most of the important tones in the scene are at the lighter end of the gray scale. The overall "average" tone would be about one stop brighter than middle gray. For a good picture you have to increase the exposure by one stop (+1) to lighten it. If you didn't do this, the snow in the scene would appear too gray (bottom).

SCENES DARKER THAN MIDDLE GRAY

Scenes that are darker than middle gray, such as deep shadows, dark foliage, and black cloth, reflect less than 18% of the light falling on them. If you photograph such scenes using automatic exposure, they will appear too light. The meter cannot tell if the scene is dark or just an ordinary scene with less light falling on it. In either case it increases the exposure to make a photograph of the scene lighter. To photograph a scene that has an overall tone darker than middle gray, you need to override the autoexposure system to decrease the exposure to make the picture darker.

The black cat is between one and two stops darker than middle gray. To darken the scene so the cat's not middle gray, exposure must be decreased by one (-1) or two (-2) stops.

SUBJECT AGAINST VERY LIGHT BACKGROUND

Subjects against a very light background such as a portrait against a bright sky or light sand or snow, can confuse an automatic exposure system, particularly if the subject occupies a relatively small part of the scene. The brightness of the background is so predominant that the automatic exposure system reduces the exposure to render the overall brightness as a middle gray. The result is an underexposed and too-dark main subject.

Here the scenes were underexposed to silhouette the people in the foreground. To show detail in the people, exposure would have had to have been increased two stops (+2).

SUBJECT AGAINST VERY DARK BACKGROUND

When a small bright subject appears against a large dark background, your autoexposure system increases the exposure to produce a middle gray tone. The result is an overexposed and too light main subject.

The rising sun illuminated only one boat in this harbor scene. If the exposure hadn't been reduced by two stops (-2), the background would be too light and the white boat would have been burned out and too white. A scene like this is a great place to use partial metering (page 47).

SCENES WITH HIGH CONTRAST

TIP

In high contrast settings, you can decrease contrast at the time you take the picture (page 117).

Many scenes, especially those with brightly lit highlights and deep shadows, have a brightness range that cannot be completely recorded on an image sensor. When confronted with such scenes, you have to decide whether the highlight or shadow area is most important, then set the exposure so that area is shown accurately in the final picture. In high contrast situations such as these, move close enough so the most important area fills the viewfinder frame. Use AE lock (page 41) from that position to lock in the exposure. Another way to deal with high contrast is to lighten the shadows by adding fill flash. A portrait, for example, lit from the back or side is often more effective and interesting than one lit from the front. But when the light on the scene is contrasty, too much of the person's face may be in overly dark shadow. In this case use fill flash (page 97) or a white reflector card to fill and lighten the shadows.

The archway was in shadow and dark while the cathedral was brightly sunlit. Both couldn't be exposed properly, so the archway was left as a solid black.

HARD TO METER SCENES

Occasionally it's not convenient or even possible to meter a scene. Neon street signs, spotlit circus acts, fireworks, moonlit scenes, and many similar situations are all difficult and sometimes impossible to meter. In these cases, it's easiest simply to experiment using exposure compensation (page 41) or autoexposure bracketing (page 42). After taking a picture at the suggested exposure, you take other exposures so they are both lighter and darker than the suggested settings.

This scene has a bright sky and one brightly illuminated fisherman against a dark background. A scene such as this is hard to meter because of the variety of lighting.

TIP

When photographing a TV or computer monitor, use a shutter speed of 1/30 second or slower.

A relatively small subject against a wide expanse of sky will almost always be underexposed unless you use exposure compensation.

HOW TO OVERRIDE AUTOMATIC EXPOSURE

Most digital cameras, including the Digital Rebel, provide one or more ways to override the automatic exposure system to get the exposure you want.

EXPOSURE COMPENSATION

Exposure compensation lets you lighten or darken the photograph that the camera would produce if autoexposure were used. To lighten a picture, you increase the exposure; to darken one, you decrease the exposure. The amount you increase or decrease the exposure is specified in "stops." For example, to increase the exposure 1 stop, you specify +1 to open the aperture or slow down the shutter speed. It's easy to use exposure compensation because you can immediately see the effects of your changes on the monitor.

Exposure compensation darkens or lightens pictures.

TIP

■ Use + exposure compensation when the subject is bright and - when it's dark.

Exposure compensation can increase or decrease exposure by two stops in one-third stop increments. Here are some typical settings where you'd make these changes.

■ **+2** is used when the light is extremely contrasty and important shadow areas are much darker than brightly lit areas.

This lighthouse in the fog on Cape Cod would have looked too dark if exposure compensation hadn't been used to lighten it.

■ **+1** is best for sidelit or backlit scenes, beach, fog, or snow scenes, sunsets and other scenes that include a bright light source, or very light objects, such as a white cat on a white pillow.

■ **0** (the default) is best for scenes that are evenly lit and when important shadow areas are not too much darker than brightly lit areas.

■ **-1** is for scenes where the background is much darker than the subject, such as a portrait in front of a very dark wall. This setting is also good for very dark objects, such as a black cat on a black pillow.

■ **-2** is for scenes of unusual contrast, as when an extremely dark background occupies a very large part of the image and you want to retain detail in the brighter parts of the scene.

The Av/Exposure compensation button icon.

An exposure scale shows you how much you are under (-) or over (+) exposed.

QuickSteps USING EXPOSURE COMPENSATION

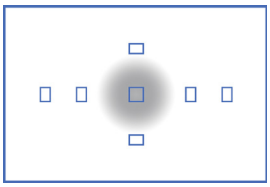
1. With the Mode Dial set to any mode in the Creative Zone except manual (M), press the shutter button halfway down to activate the displays, and then hold down the Av/Exposure Compensation button with your thumb as you turn the Main Dial to move the marker on the exposure scale displayed in the viewfinder and on the LCD panel.
   - To darken the image, move the marker toward the minus (-) end of the scale.
   - To lighten the image, move the marker toward the plus (+) end of the scale.
2. When done, reset exposure compensation to 0 otherwise it will be remembered even when you turn off the camera.

TIP

- When using the built-in or external Speedlight, the AE/FE Lock button locks in flash exposure (page 101).

AUTOEXPOSURE LOCK (AE)

When the subject you want to expose correctly isn't covered by a focus point, you can lock focus and exposure by pressing the shutter button halfway down and then recompose the image. However, in Creative Zone modes you can also lock exposure separately from locking focus using the AE/FE Lock button (an * asterisk-like icon). This allows you to lock exposure on one subject or scene, and then recompose and refocus the image without the exposure setting changing. When you press the AE/FE Lock button the camera uses partial metering to set the exposure so only the center 9% of the scene as shown in the viewfinder is metered.



Partial metering is used with AE lock to base the exposure on just the center 9% of the screen.

AE lock can be a very useful technique when you want to be sure that one part of a scene is exposed correctly. For example, if you photograph a barn in the middle of a snow-covered landscape, the image will most likely be underexposed and too dark because so much of the scene is white snow that the camera will capture as middle gray. However, using AE lock, you can move in on the barn so it fills the center 9% of the viewfinder and lock exposure. You can then move back to shoot the barn with the exposure you locked in from close up. When you do this focus is locked in from the actual shooting position. In other situations you may not move, just swing the camera slightly to lock exposure on one part of the scene and then recompose the image in the viewfinder before taking the picture.

The AE/FE Lock icon.

QuickSteps USING AUTOEXPOSURE (AE) LOCK

1. With the flash closed or off and the Mode Dial set to any mode in the Creative Zone other than manual (M), focus so the part of the scene on which you want to lock exposure fills the central 9% of the viewfinder.
2. Press the shutter button halfway down and then release it to activate the displays. Press the AE/FE Lock button (an * asterisk-like icon) and the * icon is displayed in the viewfinder to indicate exposure is locked.
3. Recompose the scene and take the picture. To cancel AE Lock, release the shutter button and wait a few seconds for the * icon to disappear. To keep it locked, continue holding the shutter button halfway down.

TIP

If you use continuous mode (page 112) for autoexposure bracketing, the series of three shots is taken when you hold the shutter button down. If you use the self-timer, you only have to press the shutter button once to take all three pictures.

AUTOEXPOSURE BRACKETING (AEB)

Instead of using exposure compensation, or in conjunction with it, you can use autoexposure bracketing (AEB) to run off a series of three images, each at a slightly different exposure—correctly exposed, overexposed, and underexposed. The difference from one shot to the next can be set at up to 2 stops in 1/3rd stop increments. White balance and focus are locked in with the first exposure. In P mode, the camera brackets by changing both the aperture and shutter speed, in Tv mode by changing the aperture, and in Av, M, and A-DEP modes by changing the shutter speed. AEB stays in effect until you change it, turn the camera off, change lenses, or turn on the flash. If you don't do one of these things or reset bracketing to 0, the camera will remain set to this mode so pictures will be captured at different exposure levels.

The AEB icon.

The exposure scale used to specify the exposure increment between shots. Here the bars indicate it's one stop.

QuickSteps USING AUTOEXPOSURE BRACKETING (AEB)

1. With the Mode Dial set to any mode in the Creative Zone, press MENU and select the shooting menu tab.
2. Highlight *AEB* and press SET to activate the exposure scale.
3. Turn the Main Dial or press the left or right cross key to expand or contract the exposure increment between shots and press SET. Three small bars under the scale indicate what the exposure will be for each of the three shots. The middle bar is at the exposure recommended by the camera (or shifted with exposure compensation—page 41) and the left and right bars indicate by how many stops the other images will be underexposed (-) and overexposed (+).
4. Press the MENU or shutter button to exit the menu and take each of the three photos just as you normally would.

   ■ While AEB is in effect, the AEB icon is displayed on the LCD panel and the three markers are displayed on the exposure scale in the viewfinder and on the LCD panel.

   ■ After you take the first shot, the above indicators and the AE/FE lock icon in the viewfinder flash. When you press the shutter button halfway down, the marker on the exposure scale indicates which of the three images is being captured. When the series is complete, the flashing stops.
5. When finished, repeat Steps 1–3 to reset AEB to 0.

Autoexposure bracketing captures a series of three shots at different exposures. Here the sequence is 0 (left), +1 (center), and -1 (right).

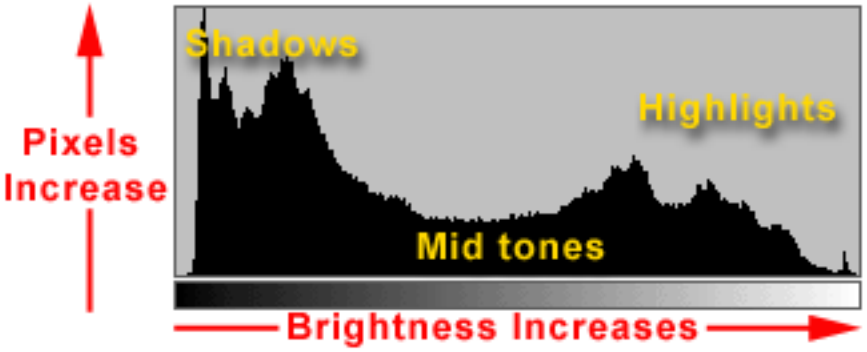
USING HISTOGRAMS

QuickSteps

DISPLAYING HISTOGRAMS

- In playback mode, scroll to the photo you want to see a histogram of and press INFO.
- When shooting, change the Review setting to *On (Info)* (page 113).

Most serious photo-editing programs such as Photoshop let you use a histogram as a guide when editing your images. As you've seen, each pixel in an image can be set to any of 256 levels of brightness from pure black (0) to pure white (255). A histogram is a graph that shows how the 256 possible levels of brightness are distributed in the image. Since most image corrections can be diagnosed by looking at a histogram, it helps to look at it while still in a position to reshoot the image. It's for this reason that histograms can be displayed on the Digital Rebel's monitor.



HOW TO READ A HISTOGRAM

TIP

When a histogram is displayed, areas in the small image next to it blink if they are overexposed to pure white without detail. This is called the *highlight alert*.

The horizontal axis represents the range of brightness from 0 (shadows) on the left to 255 (highlights) on the right. Think of it as a line with 256 spaces on which to stack pixels of the same brightness. Since these are the only values that can be captured by the camera, the horizontal line also represents the camera's maximum potential dynamic range.

The vertical axis represents the number of pixels that have each of the 256 brightness values. The higher the line coming up from the horizontal axis, the more pixels there are at that level of brightness.

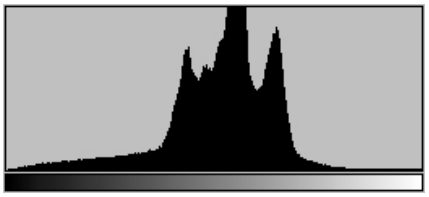
To read the histogram, you look at the distribution of pixels. An image that uses the entire dynamic range of the camera will have a reasonable number of pixels at every level of brightness. An image that has low contrast will have the pixels clumped together and have a narrower dynamic range.

SAMPLE HISTOGRAMS

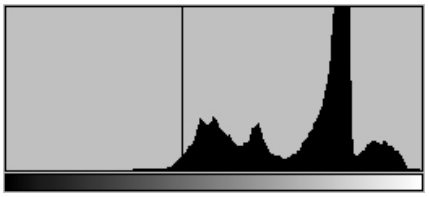
The way a histogram looks depends on the scene you're shooting and how you expose it. There's no such thing as a good or bad histogram. Whether a particular histogram is good or bad depends on what you are trying to accomplish. If fact, you may prefer to trust your visual reaction to the image more than the very graphical image data provided by a histogram. However, even if you never use a histogram, you can learn about digital images by understanding what a histogram can show about an image. Following are some histograms from good images along with a brief summary of what each histogram reveals.

In this well exposed portrait there is a fairly even distribution of values in both the shadow and highlight areas of the image. There are no pure blacks as shown by the gap at the far left end of the histogram.

This brown moth on a gray card has most of its values in the midrange. That's why there are a number of high vertical lines grouped in the middle of the horizontal axis.

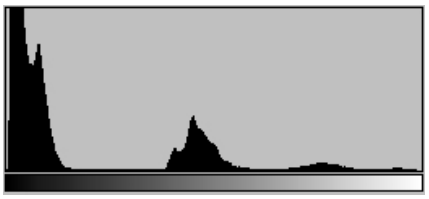


This high-key fog scene has most of its values toward the highlight end of the scale. There are no really dark values in the image. The image uses only a little more than half the camera's dynamic range.

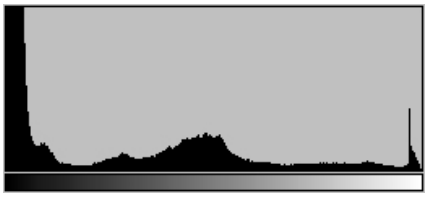


The distinct vertical line to the left of middle gray shows how many pixels there are in the uniformly gray frame border added in Photoshop.

This low-key scene has the majority of its values in the shadow area with another large grouping around middle gray. There are numerous brightness levels that have only a few pixels.



This night scene with flash has a lot of dark pixels but then there are other values fairly evenly distributed across the entire range.



QuickSteps

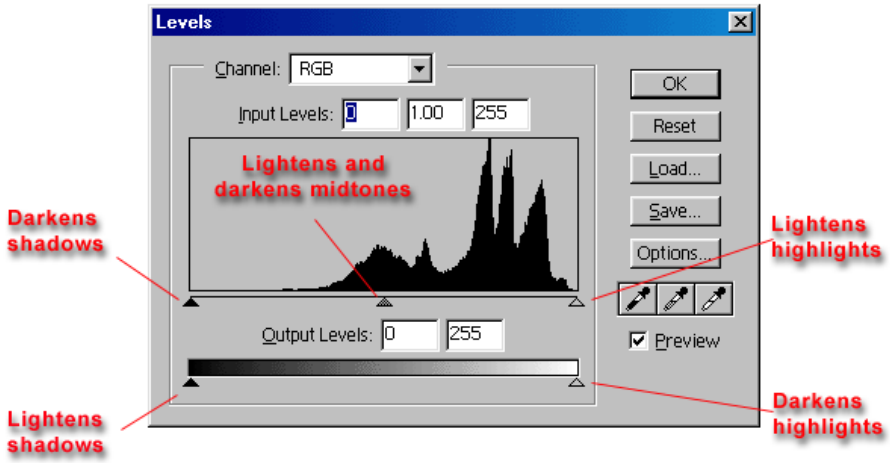
USING HISTOGRAMS

- If the histogram shows most pixels toward the left (darker) side of the graph, use exposure compensation to add exposure (page 41).
- If the histogram shows most pixels toward the right (lighter) side of the graph, use exposure compensation to reduce exposure (page 41).

CORRECTING IMAGES

One reason to check a histogram is to see if there are enough pixels in the shadow, midtone, and highlight areas. If there are enough, even if the image is somewhat off, it can be corrected in a program such as Photoshop using the Levels command. These controls allow you to adjust the shadow, mid, and highlight areas independently without affecting the other areas of the image. This lets you lighten or darken selected areas of your images without loosing detail.

From the histogram you can determine the image's darkest shadow and brightest highlights; called the black point and white point. In fact, it's the range between these two points that defines the dynamic range (also called the tonal range or contrast) of the image. If the image is low contrast, you can also tell if it's low-key or high-key from the histogram. A low key image has details concentrated at the dark end of the scale. A high-key image has them concentrated at the light end.



In Photoshop, the Levels dialog box gives you five triangles you can drag to adjust the distribution of brightness in your image.

The three triangles below the histogram work as follows:

- Dragging the left (black) triangle to the right darkens the shadows.
- Dragging the right (white) triangle to the left lightens the highlights.
- Dragging the middle triangle to the right or left lightens or darkens the image.

The two triangles below the Output Levels gray scale bar also adjust the image when you drag them, having almost the opposite affect of the triangles above.

- Dragging the left (black) triangle to the right lightens the shadows.
- Dragging the right (white) triangle to the left darkens the highlights.

Chapter 3
Controlling Sharpness

CONTENTS

■ Getting Sharper Pictures ■ Sharpness Isn't Everything ■ How to Photograph Motion Sharply ■ Focus and Depth of Field ■ Controlling Depth of Field ■ Capturing Maximum Depth Of Field ■ Using Selective Focus ■ Conveying the Feeling of Motion

One of the first things you notice about a photograph is whether or not it is sharp. Extremely sharp photographs reveal a richness of detail, even more than you would normally notice in the original scene. If the entire image isn't sharp, your eye is immediately drawn to the part that is. When learning to control sharpness, the first goal is to get pictures sharp when you want them sharp. If your photos aren't as sharp as you want them to be, you can analyze them to see what went wrong.

■ **Focus**. If nothing in your image is sharp or if your central subject is not sharp but other parts of the photograph are, your camera was improperly focused.

■ **Depth of Field**. If your central subject is sharp but the background or foreground is less so, you may not have used a small enough aperture to get the depth of field you wanted.

■ **Camera Movement**. If the image is blurred all over, with no part sharp, the camera moved during the exposure. Some dots appear as lines and edges are blurred because the image was "painted" onto the moving image sensor.

■ **Subject Movement**. When some of the picture is sharp but a moving subject appears blurred, your shutter speed was too slow.

GETTING SHARPER PICTURES

Unwanted camera movement when the shutter is open is one of the major causes of unsharp photographs. You can reduce this problem in bright light and when using flash simply by holding the camera steady and depressing the shutter button smoothly. At slow shutter speeds, such as those you get in dim light, particularly with a long focal length lens, you need a camera support.

> TIP
>
> The optional remote controller (RC-5) can trigger the shutter from up to 16.4 feet (5m) in front of the camera.

SUPPORTING THE CAMERA

As the focal length of your lens changes, so does the minimum shutter speed you need to hand-hold the camera without getting any blur from camera shake. The rule of thumb is never to hand-hold the camera at a shutter speed lower than your lens' focal length. For example, a 100mm lens can be handheld at a shutter speed of 1/125 or faster. (The camera displays the current shutter speed on the LCD panel and in the viewfinder when you press the shutter button halfway down.)

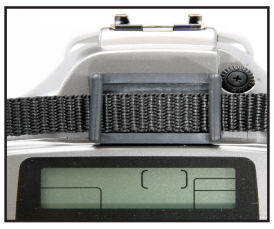
Monopods are light, collapsible, and easy to carry. Courtesy of Gitzo at (www.gitzo.com).

When photographing in dim light without flash, you need to support the camera to prevent blur in your images. One way to do this is to lean against a wall or tree and brace yourself with your elbows tight to your body. You can also find a branch or railing to rest the camera on. For real stability you need a small tripod or an even easier to carry monopod.

To hand hold the camera as steady as possible, brace the camera against your face and brace your elbows against your sides. Just before taking a shot, inhale deeply, then exhale and hold your breath while smoothly depressing the shutter button. When holding the camera for both horizontal and vertical photographs use your right finger to press the shutter button and your left hand to support the camera.

The camera was steady for the left picture and moved for the right one.

USING THE SELF-TIMER/REMOTE CONTROL



The eyepiece cover over the viewfinder blocks light from entering and affecting the exposure when using the self-timer.

The Digital Rebel has a self-timer that gives you a 10 second delay between the time you press the shutter button and the picture is taken. You can also use an optional remote switch (RS-60E3) or wireless remote control (RC-5 or RC-1) to trigger the shutter. Although often used to give you time to get into a picture, using the self-timer or remote is also a great way to reduce blur when photographing in dim light. Just place the camera on a stable surface, compose the image, and use the timer to take the picture without any camera shake. Don't stand in front of the camera when you press the shutter button to start the timer. If you do so, you'll prevent the camera from focusing correctly. If using the timer to photograph yourself, focus it on something at the same distance at which you will be positioned.

The self-timer/remote icon.

TIP

- After using the remote control to take a picture, you must wait until the access lamp near the cross keys turns off before taking another. This can take about 5–10 seconds when shooting large or medium images and 10–20 seconds when using the RAW format.
- Some fluorescent lights will prevent the wireless remote from operating correctly.
- Canon makes a number of lenses that use image stabilization (IS) to get sharper pictures (page 79).
- To take your own picture using the self-timer, lock focus on something at the same distance you will be when you scramble into position.

QuickSteps USING THE SELF-TIMER/REMOTE CONTROL

1. With the camera on and in any exposure mode, press the DRIVE button on top of the camera repeatedly until the self-timer/remote icon is displayed on the LCD panel.
2. With the camera on a stable surface or tripod, and pointed at the subject you want it to focus on, do one of the following:
   - Press the shutter button halfway down to set focus, then all the way down to start the timer. The red-eye/self-timer lamp on the front of the camera flashes, the camera beeps, and the LCD panel displays a countdown timer. Two seconds before the picture is taken, the lamp glows steady and the beep rate increases. (To interrupt the timer, press the DRIVE button.)
   - Point the remote toward the remote control sensor on the front of the camera and press the transmit button. For two seconds before the picture is taken, the lamp glows steady and the beep rate increases.
3. When finished, repeat Step 1 to reset the camera to single-frame mode.

INCREASING SENSITIVITY

To reduce blur caused by camera movement, you can increase the image sensor's ISO although this adds some noise to the image. ISO is a term used to designate film speeds, or how sensitive they are to light. There is no equivalent standard for digital cameras but the sensitivity of a sensor is given as an ISO equivalent.

Increasing sensitivity is also a good way to get pictures without using flash in places such as concerts and museums where flash is prohibited, or when photographing fast-moving subjects. Increasing the sensitivity means less light is needed for a picture so the shutter speed is faster. In Basic Zone modes the camera sets the ISO automatically, but in Creative Zones you can change it.

- When not using flash in Full Auto, Landscape, Close-up, Night Portrait, and Flash Off modes, the camera chooses an ISO of 100, 200, or 400 depending on the light. In Portrait mode it stays fixed at 100 and in Sports mode at 400.
- When using flash in Full Auto, Close-up, and Night Portrait modes, the ISO is set to 400 unless the subject is backlit, in which case it's set to 100. In Portrait mode, it is fixed at 100.
- When using an external flash, the ISO is fixed at 100 in Basic Zone modes, except Sports where it is fixed at 400.
- When using Creative Zone modes, you can set the ISO to 200, 400, 800, or 1600, but the higher your set it the more noise you'll get.

QuickSteps CHANGING THE ISO

- With the Mode Dial set to any mode in the Creative Zone, press and release the ISO button (the up cross key) and then turn the Main Dial to scroll through the available ISO settings displayed on the LCD panel.

Sharpness Isn't Everything

Your photos don't have to be sharp to be effective. In many cases, it's better to have part of the scene sharper than the rest. Your pictures can be sharp or unsharp in different ways. The first way concerns motion. Several factors affect the way motion is captured in images. These include your image sensor's ISO, the overall brightness of the scene, lens focal length, and subject speed, direction, and distance. Another kind of sharpness concerns depth of field, how much of the scene will be sharp in the image from foreground to background. Even if you are photographing a static scene, your picture may not be sharp if you do not have enough depth of field. However, a shallow depth of field can be used to make a busy background less distracting by having it out of focus in the picture. Several factors affect depth of field, including lens aperture, lens focal length, and subject distance.

Motion in a scene can be frozen or blurred depending on the shutter speed and other factors. Blur can be used creatively to evoke a feeling of motion as in this shot of a waterfall in Yosemite National Park.

Shallow depth of field can focus attention on a foreground subject by making the background less sharp.

How to Photograph Motion Sharply

The sharpness of different parts of an image helps direct the viewer who tends to look first at the most sharply focused part of the picture. In addition, sharpness itself can be part of the message of the photograph. The immobility of a frozen figure can be made more apparent by blurring people moving in other parts of the scene.

Blur in an image is caused when all or part of a subject focused onto the image sensor moves when the shutter is open. To show a moving subject sharply, the shutter needs to open and close before the image on the sensor moves a significant amount. In other words, you need to use a fast shutter speed. But just how fast is fast enough? The answer depends on several factors. Because several variables are involved, you can't always predict how motion will be portrayed in the final photograph. So use different settings and take more than one shot if possible. Try shooting from a different angle or perhaps wait for a pause in the action. You are much more likely to get a good shot if you have several to choose from. Just be aware that sharpness and blur are hard to evaluate on the camera's monitor.

Speed of Subject

The faster a subject is moving, the faster the shutter speed you need for a sharp image. However, it's not the speed of the subject in the real world that determines blur. It's how far the subject moves on the image sensor while the exposure is being made. This depends not just on the subject's actual speed, but also on the direction of its movement, its distance from the camera, and the focal length of the lens.

The shutter speed was fast enough to freeze the butterfly on the flower but too slow to freeze the one flying by. This makes the still butterfly the most important part of the photograph.

Direction of Movement

When the shutter is open, a subject moving parallel to the image sensor crosses more of the pixels on the sensor and is more blurred than a subject moving directly toward or away from the camera. This is why you can use a slower shutter speed to sharply photograph a subject moving toward, or away from you, and not the same subject moving from one side to the other.

DISTANCE TO SUBJECT AND FOCAL LENGTH OF LENS

If a subject is close to the camera, even slight movement is enough to cause blur. A subject—or part of one—far from the camera can move a considerable distance before its image on the image sensor moves very much. The focal length of the lens can also affect the apparent distance to the subject. Increasing the focal length of your lens—for example, zooming in on a subject—has the same effect as moving closer to your subject. The longer the focal length of the lens, the less a subject has to move for its image to move on the image sensor and become blurred.

To visualize the effects of distance on blur, look out the side window of a speeding car (but not when you're driving). The objects in the foreground seem to fly by while those on the horizon don't seem to move at all.

On this speeding train, the part closest to the camera looks the most blurred while the farthest part looks sharper. Since all parts of the train are moving at the same speed, this shows how distance affects blur.

QuickSteps INCREASING THE SHARPNESS OF MOVING OBJECTS

- Photograph fast-moving subjects heading toward or away from you and not from side to side.
- Move farther back from the subject.
- Use a shorter focal length lens or zoom to a wider angle of view.
- Switch to Tv (shutter-priority) mode (page 27) or use program shift (page 25) and select a fast shutter speed such as 1/500.
- Increase the camera's ISO so you can use a faster shutter speed although this adds some noise to the image (page 48).
- Use flash to freeze the action (page 94).

Focus and Depth of Field

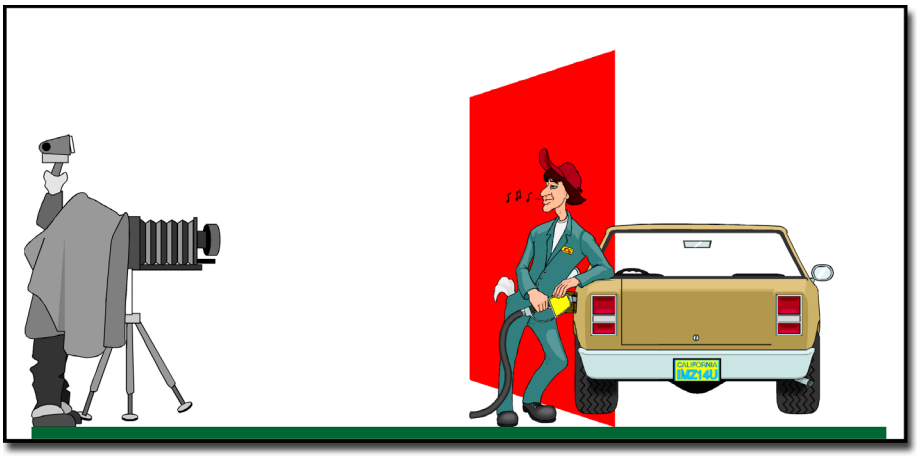
If you look around you—the book in your hand, the chair across the room, the far wall—everything seems to be sharp. That is because your eyes refocus every time you look at an object at a different distance. But the sharpness you see when you glance at a scene is not always what you get in a photograph of that scene. To understand why not, you have to understand focus and depth of field.

Focus

Focus is only one of the factors affecting the apparent sharpness of your photographs, but it is a critical one because it determines which part of the picture will be sharpest—called the *plane of critical focus*. You will have much more control over the final image if you understand how focus relates to the overall sharpness of a scene.

Plane of Critical Focus

The plane of critical focus in your image will be the area that falls on the active focus point in the viewfinder—the one that flashes a red dot. As you point the camera at various subjects and press the shutter button halfway down, you'll see the subjects pop into focus.



Imagine the part of the scene on which you focus as a flat plane (much like a pane of glass) superimposed from one side to the other of a scene, so that the plane is parallel to the back of the camera or the image sensor. Objects falling exactly on this imaginary plane will be in critical focus, *the sharpest part of your picture. This plane of critical focus is a very shallow band and includes only those parts of the scene located at identical distances from the camera. As you point an autofocus camera at objects nearer or farther away in the scene, the plane of critical focus moves closer to or farther away from the camera. As the plane moves, objects at different distances from the camera come into or go out of critical focus.*

Depth of Field

If you look at photographs, you can see a considerable area of the scene from near to far that appears sharp. Even though theoretically only one narrow plane is *critically sharp*, other parts of the scene in front of and behind the most sharply focused plane appear *acceptably sharp*. This area in which everything looks acceptably sharp is called *depth of field*. Objects within the depth of field become less and less sharp the farther they are from the plane of critical focus. Eventually they become so out of focus that they no longer appear sharp.

Tip

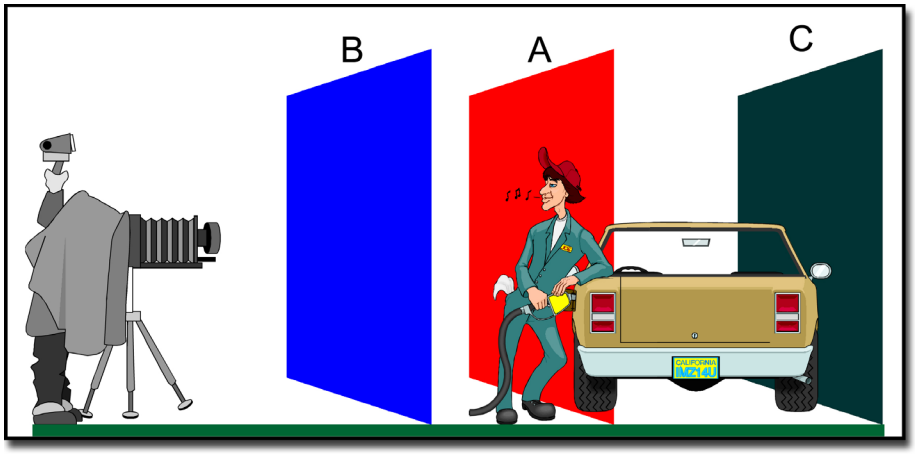
To control depth of field, switch to Av (aperture-priority) mode and select a small aperture for great depth of field, or a large aperture for shallow depth of field (page 29.)

Often it doesn't matter so much exactly what you are focused on. What does matter is whether or not all of the objects you want to be sharp are within the depth of field so they appear sharp. If you want a large part of the scene to be sharp, you can increase the depth of field. You can decrease it if you want less of the scene sharp. In some scenes, you can significantly increase or decrease

TIPS

- To check depth-of-field press the depth-of-field preview button (page 57).
- You choose an autofocus mode indirectly by choosing an exposure mode.

the depth of field simply by shifting the point on which you are focused or by changing the aperture setting.



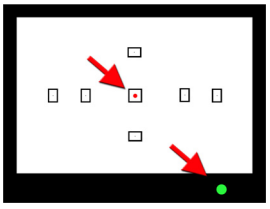
The near and far limits of depth of field are shown here as two planes (B and C), parallel to the plane of critical focus (A). Actually, they are usually not visible as exactly defined boundaries. Instead, sharp areas imperceptibly merge into unsharp ones. Notice that in the diagram the depth of field is not evenly divided. At normal shooting distances, about one-third of the depth of field is in front of the plane of critical focus (toward the camera), and two-thirds is behind it (away from the camera). When the camera is focused very close to an object, the depth of field becomes more evenly divided.

Lens focus switch set to autofocus (AF). Manual focus is indicated by an M *or* MF.

AUTOFOCUS (AF)

When the lens switch is set to AF, the Digital Rebel focuses on the nearest subject covered by one of the seven focus points displayed in the viewfinder. A red dot flashes briefly in the AF point or points used to set focus when focus is achieved.

- The plane of critical focus in your image will be the area that falls on the active focus point in the viewfinder—the one with a dot that flashes red. As you point the camera at various subjects and press the shutter button halfway down, you'll see them pop into focus.
- To check depth-of-field in the viewfinder when using Creative Zone modes, press the depth-of-field preview button (page 57). In A-DEP mode you must first hold the shutter button halfway down.



When autofocus is locked, the focus confirmation lights green and a red dot briefly flashes in the active focus point.

The Digital Rebel's autofocus system is passive and uses contrast to set the focus. In dim light, if you have trouble focusing, you can pop up the flash and it will strobe when you press the shutter button halfway down. (It will do this automatically in Full Auto mode.) The technique works up to about 13 feet (4m).

The Digital Rebel has three autofocus modes—One-Shot, AI Servo, and AI Focus. You can't select one of these modes, but the camera will when you select an exposure mode.

- **One-Shot** autofocus mode (used in Portrait, Landscape, Close-up, Night Portrait, and A-DEP exposure modes) locks focus on a subject covered by one of the focus points when you press the shutter button halfway down and focus remains locked as long as you hold the button down. This mode is best for stationary subjects such as portraits and landscapes and when using focus lock (page 56). In this mode, the camera will not shoot until focus is locked. To change focus once it's locked, you must release the shutter button and then press it halfway down again.

TIP

■ An external Speedlight (page 102), will emit an AF-assist beam so the camera can focus in the dark. The camera may not be able to focus if you have selected an off-center focus point.

■ **AI servo** mode (used in Sports exposure mode) continually adjusts the focus as long as you hold the shutter button halfway down. This keeps a moving subject in focus and is great for sports and nature photography, or any other situations where you are photographing fast-moving subjects. The camera first locks focus using the central AF point, but then keeps the moving subject in focus as long as it's covered by one of the seven focus points. When focus is achieved in this mode the focus confirmation light doesn't light, the beeper doesn't sound, and a red dot doesn't flash in the active focus point. In this mode the camera will shoot even when a subject isn't in focus and exposure is determined just before the picture is taken.

■ **AI focus** mode (used in Full Auto, Flash Off, P, Tv, Av, and M exposure modes) focuses on the subject using One-Shot mode, but if the camera detects that the subject then starts to move, it automatically switches to AI servo mode so it can keep the subject in focus.

TIPS

■ When using autofocus, don't turn the focusing ring on the lens.

■ Zoom the lens before focusing. Turning the zoom ring after achieving focus may throw off the focus.

■ You can silence the focus confirmation beep using the *Beep* command on the shooting menu tab.

AF-ASSIST BEAMS

In dim light if the built in flash is popped up or an attached Speedlight is on (page 102), it will fire a burst of flashes to illuminate the subject and assist focusing. This happens in all exposure modes other than Landscape, Sports, and Flash Off. The range of the built-in flash's AF-assist beam is effective up to about 13 feet (4m).

If the camera can't focus with an external Speedlite's AF-assist beam, select the center AF point because it may not be able to focus using an off-center AF point.

AUTOFOCUS PROBLEMS

If the camera can't focus, the focus confirmation light flashes in the viewfinder. This happens with:

■ Subjects with very low contrast, such as those with even expanses of a single color such as a blank wall or clear blue sky.

■ Subjects that are backlit or have reflective surfaces.

■ Subjects in very dark settings.

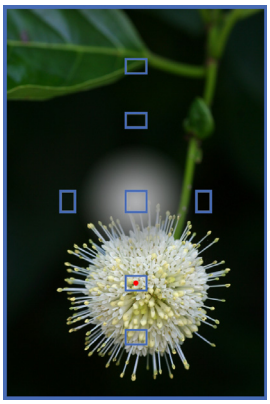
■ Overlapping subjects at different distances.

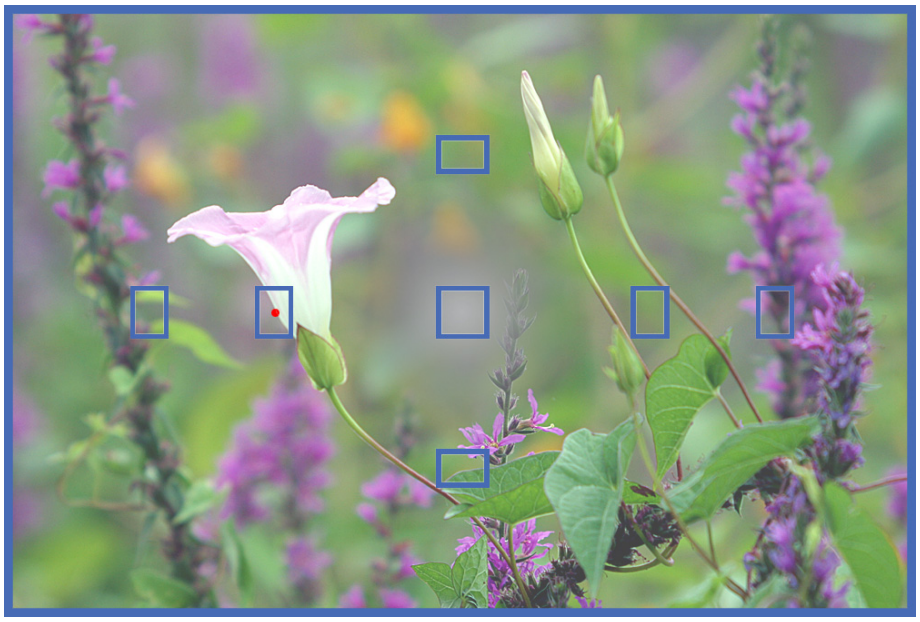
In these situations you might try selecting another focus point manually, use focus lock, or manually focus the lens. Lets see how these techniques work.

SELECTABLE FOCUSING POINTS

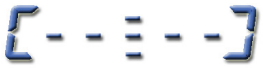
The Digital Rebel has seven selectable focus points. In Basic Zone and A-DEP modes, the camera chooses the focus point that covers the closest part of the scene—expect in Sports mode where it uses the center point. However, in Creative Zone modes other than A-DEP (page 58) which always uses auto, you can switch between automatic and manual selection. When manually selecting a focus point, the one being used, called the *active focus point*, is indicated on the LCD panel with a dash and in the viewfinder with a red dot. Manually selecting a focus point lets you choose which part of the scene is used to focus the camera and also lets you get shots off more quickly since the camera doesn't have to take time calculating where to focus.

A red dot briefly flashes in the AF point used to set focus horizontally (right) or vertically (below).





AF point selector icon.



The selected focus point is indicated on the LCD panel. When all seven focus points are shown, the camera selects the one to use.

QuickSteps SELECTING A FOCUS POINT

1. With the Mode Dial set to any mode in the Creative Zone other than A-DEP, press the AF point selector button (seven dot icon) on the back of the camera to display the currently selected focus point indicator in the viewfinder with red dots and on the LCD panel with dashes.
2. Turn the Main Dial to select the desired AF point. (When all seven points are indicated, you are in auto mode and the camera will pick the focus point for you.)
3. When finished, repeat Steps 1 and 2 to reset focus point selection to auto (all seven dots). If you don't do so, the setting remains in affect even when you turn the camera off.

USING FOCUS LOCK

To change the position of the plane of critical focus in all modes other than Sports, you can use focus lock. The Digital Rebel has a two-stage shutter button. When you press it halfway down, the camera sets focus, and also exposure if you are using evaluative metering (page 33). When the focus confirmation light in the viewfinder glows a steady green, these readings are locked in. If you don't release the shutter button, you can then point the camera anywhere else and the settings remain unchanged. This lets you set the focus at any distance from the camera to control both focus and depth of field.

TIPS

■ You can lock focus and exposure independently using AE Lock (page 41).

QuickSteps USING FOCUS LOCK

1. Compose the image so the subject you want to lock focus on is covered by one of the focus points in the viewfinder.
2. Press the shutter button halfway down and hold it there to lock in focus. The green focus confirmation light lights up and the focus point being used to set focus briefly flashes red in the viewfinder.
3. Without releasing the shutter button, recompose the scene and press the shutter button all the way down to take the picture.

TIP

■ Hold the shutter button halfway down as you manually focus and when a subject covered by a focus point comes into focus, a red dot in that focus point flashes red.

MANUAL FOCUS

To manually focus, set the lens' focus switch to M or MF (for Manual) and focus by turning the lens' focus ring. If you are using an USM (Ultrasonic Motor) lens that has a distance scale in One-Shot AF mode, you can turn the focusing ring on the lens to fine tune focus after focus is achieved (called *full-time manual focusing*). Manual focus is best when autofocus has problems, or when you want to quickly focus on an off-center subject or a subject that is in a busy setting where the camera has trouble isolating the subject you want. If you press the shutter button halfway during manual focusing, a red dot flashes in the active AF point and the focus confirmation lights in the viewfinder light when focus is achieved.

QuickSteps USING MANUAL FOCUS

1. Set the focus switch on the lens to M or MF.
2. While looking through the viewfinder, focus by turning the focus ring on the lens.

Manual focus is useful when the main subject doesn't fall on one of the seven focus points, or when you want to focus on a very specific spot such as the eye of a moth.

Controlling Depth of Field

Sharpness—or the lack of it—is immediately noticeable when you look at a photograph. If you are making a portrait, you may want only the person to be sharply focused, but not a distracting background. In a landscape, on the other hand, often you may want everything sharp from close-up flower to distant mountain. Once you understand how to control depth of field, you will feel much more confident when you want to make sure something is—or isn't—sharp.

Here the greatest possible depth of field was used to keep everything sharp from the fighter's needle nose to the background.

Here the camera's depth of field was just deep enough to keep the legs in focus. Parts of the image closer to the camera and further away become increasingly less sharp.

To control how deep or shallow depth of field is, you have three factors to work with.

- **Aperture size**. The smaller the size of the lens aperture (the larger the f-number), the greater the depth of field. The larger the aperture, the shallower the depth of field.
- **Camera-to-subject distance**. As you move father from the subject you are focused on, you increase depth of field. As you move closer, you decrease it.
- **Lens focal length**. Shorter focal length lenses increase depth of field and longer focal length lenses decrease it.

Each of these three factors affects depth of field by itself, but even more so in combination. You can get the shallowest depth of field with a long focal length lens focused on a nearby subject using a large aperture. You get the deepest depth of field when you are far from a subject, with a short focal length wide angle lens, and using a small aperture.

Depth of field preview button.

To check depth-of-field in the viewfinder in a Creative Zone mode, press the depth-of-field preview button on the lower left side of the lens mount. (In A-DEP mode you have to first hold the shutter button halfway down.) This button locks exposure and closes the lens aperture down to the f/stop you've selected so you can get an idea in the viewfinder of what's sharp and what isn't. The problem is that when using small apertures, the viewfinder image is very dark. When the maximum aperture is selected, as it often is in dim light, you'll see no change at all.

CAPTURING MAXIMUM DEPTH OF FIELD

When photographing many scenes, you want to keep as much of the scene in focus as possible. To do so, you need to know how to increase depth of field. There are a number of ways to do this depending on the situation.

QuickSteps INCREASING DEPTH OF FIELD

- Photograph in bright sun so you can select a smaller aperture.
- Use a wider-angle lens.
- Move farther away from the subject.
- Switch to Av (aperture-priority) mode (page 29) or use program shift (page 25) to select a small aperture such as f/11.
- Use Landscape mode (page 24).

AUTO DEPTH-OF-FIELD AE (A-DEP)

The Digital Rebel has an auto depth of field (A-DEP) mode specially designed to help you get the depth of field you want. In this mode the camera evaluates all focus points and selects an aperture that will give enough depth of field to keep all of them in focus. Since the aperture setting is given priority, the shutter speed may be so low you need to use a tripod or other support. This is an ideal mode when photographing groups and landscapes. If you use flash in this mode, the mode operates just like Programed AE (P).

TIP

- To check depth-of-field in the viewfinder when using A-DEP mode, press the shutter button halfway down and hold it there as you press the depth-of-field preview button (page 57).

QuickSteps USING AUTO DEPTH-OF-FIELD AE (A-DEP)

1. With the focus switch on the lens set to AF and the flash closed, set the Mode Dial to A-DEP.
2. Compose the image so the near and far points in the scene that you want in focus are covered by one of the seven focus points in the viewfinder.
3. Press the shutter button halfway down and red dots flash in the focus points used to set near and far focus. If the aperture value is blinking it means exposure is OK but the camera can't get the desired depth of field. Recompose the image, use a wider focal length lens, or move farther away and try again.

HYPERFOCAL DISTANCE & ZONE FOCUSING

There are times when you want as much depth of field as possible because important parts of a scene that you want sharp are both near to and far from the camera. Maximum depth of field seems particularly important for photographs of landscapes and other scenes where a distant horizon is a part of the picture.

When a subject extends to the far distance, many photographers unthinkingly focus on that farthest part of the scene. But since one-third of the available depth of field falls in front of the point on which you are focused and two-thirds behind it, focusing on the most distant part of the scene wastes two-thirds of your depth of field. That may mean that some other part of the scene in the foreground will not be included in the one-third remaining depth of field and consequently will not be sharp.

TIP

■ To use focus lock for maximum depth of field, focus on something about one-third of the way between you and the horizon or between the nearest and farthest points that you want to be sharp.

For more depth of field, focusing on some object one-third of the way between you and the horizon brings forward the plane of critical focus and increases the depth of field in the foreground of your picture. This new point of focus is called the *hyperfocal distance*, defined as the point closest to the camera on which you can focus while still keeping things acceptably sharp at infinity. Canon EF lenses, with their manual focus capabilities, give you the opportunity of using an old technique of focusing on the hyperfocal distance. When you do so, the depth of field extends from halfway to the hyperfocal distance all the way out to infinity. For landscapes, this provides you with the deepest possible depth of field that you can obtain with the current aperture and lens focal length you are using.

Understanding hyperfocal distance has a side benefit. It lets you pick the sharpest possible aperture while still getting the depth of field you want. The smallest apertures may give greater depth of field, but they also have interference patterns that soften the image. For the sharpest possible images, you should use the largest aperture that will give you the depth of field you need.

Here the infinity symbol on the distance scale has been aligned with f/11 (the selected aperture) on the right side of the scale (1). On the left side of the scale (2), read up from f/11 to see that everything from about 2.5 feet (0.7m) to infinity is in focus.

QuickSteps SETTING YOUR LENS TO THE HYPERFOCAL DISTANCE

1. With the focus switch on the lens set to M or MF, set the Mode Dial to M (manual) or Av (aperture-priority) mode so you can select the aperture.
2. Turn the lens' focus ring to align the infinity mark on the right side of the lens' depth of field scale with the f-stop you're using (1 in illustration left). Read the nearest focus distance by reading up from the same aperture number on the left side of the scale (2 in illustration left).

For action photography, you can use a variation of this technique, called *zone focusing*, to prefocus and set depth of field so a specific range is always in focus. If anything happens within that range you can quickly capture it without focusing.

Here 6 feet (2m) on the distance scale has been aligned with f/11 on the right side of the scale (1). On the left side of the scale, read up from f/11 on the other side of the scale (2) to see that everything from about 1.75 feet (0.6m) to 6 feet (2m) is in focus.

QuickSteps ZONE FOCUSING

1. With the focus switch on the lens set to M or MF, set the Mode Dial to M (manual) or Av (aperture-priority) mode so you can select the aperture.
2. Turn the lens' focus ring to align the maximum focus distance on the lens' depth of field scale with the f-stop you're using on the right side of the scale (1 in illustration left). Read up from the f-stop on the left side of the depth of field scale to see what the minimum focus distance is (2 in illustration left).

USING SELECTIVE FOCUS

Imagine you are photographing a subject something like the one below. Which part of the scene are you most interested in? Chances are it's the head in the foreground and not the one in the background. One way to make something stand out is to photograph it so it will be sharper than its surroundings. When everything in a picture is equally sharp, the viewer tends to give equal attention to all parts of the scene. But if some parts are sharp and others are not, the eye tends to be drawn to the sharpest part of the image.

You can selectively focus the camera and your viewer's attention on the most important part of the scene if you restrict the depth of field so that the significant elements are sharp while the foreground and background are less so.

With the background head out of focus (right), your eye is immediately drawn to the foreground figure. When both are sharp (above), that doesn't happen as quickly.

TIPS

- The best way to decrease depth of field is to switch to Av (aperture-priority) mode and select a large aperture such as f/3.5 (page 29).
- For the shallowest depth of field move close, use a long focal length lens, and select a wide aperture.

QuickSteps DECREASING DEPTH OF FIELD

- Photograph in dim light or use a neutral density filter (page 89) so you can select a large aperture.
- Zoom the lens in to enlarge the subject or use a longer focal length lens.
- Move closer to the subject.
- Use focus lock (page 56) and focus the camera on, or slightly in front of, the subject you want sharpest.
- Use A-DEP mode (page 58) but align all focus points on the same subject.
- Use Portrait mode in the Basic Zone (page 24).

CONVEYING THE FEELING OF MOTION

Panning with this barred owl blurred the background and created an impressionistic image.

Blur can contribute a feeling of motion to the image that may be missing from a more static shot. A slow shutter speed, or one of the other techniques described here, causes a moving subject to move across the image sensor during the exposure causing a blur that conveys a strong sense of motion. These techniques often work best with a long lens or a big subject so the subject doesn't look too small in the image. One place to begin is to shift to Tv (shutter-priority) mode and pick a slow shutter speed. You can use this setting to deliberately blur moving objects such as running water.

Panning the camera in the same direction as a moving subject produces an image where the subject is relatively sharp against a blurred background. Your movement should be smooth and controlled to get a good pan, so begin to pan the camera before the subject enters your viewfinder. Smoothly depress the shutter button as you follow the motion of the subject, keeping it in the same position in the viewfinder. Follow through as you would in golf or tennis. Panning takes practice so take as many images as you can and delete those that don't work. Results are quite unpredictable here because your body motion adds yet another variable to the final picture.

Panning the camera as this young great blue heron took off blurred the background.

TIPS

- When panning with a moving subject, select an exposure mode that uses AI Servo autofocus (page 54) to keep the image focused as long as you hold the shutter button halfway down.
- In M (manual) exposure mode and dim light you can select bulb (page 73) to keep the shutter open as long as you hold down the shutter button. It will be hard to control exposure so you'll have to experiment.

QuickSteps CAPTURING CREATIVE BLUR

- Set the camera to Tv (shutter-priority) mode (page 27) or program shift (page 25) and select a slow shutter speed.
- Try blurring images in low-light situations. In bright light, the shutter will open and close too fast.
- In some situations, you may want to turn the flash off when trying to blur nearby subjects (page 99).
- Use slow sync flash (page 98).

Chapter 4
Capturing Light & Color

CONTENTS

■ Where Does Color Come From? ■ Color Balance ■ Color Balance and Time of Day ■ Sunsets and Sunrises ■ Weather ■ Photographing at Night ■ The Direction of Light ■ The Quality of Light

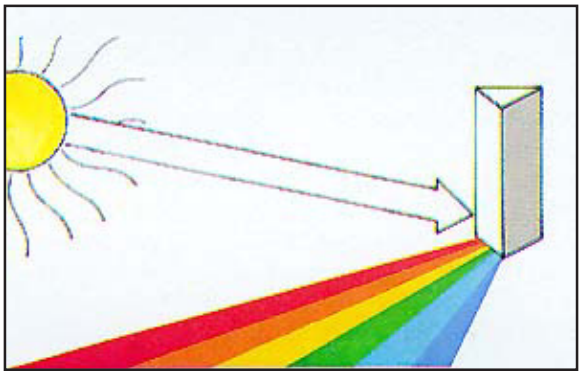
Image sensors in digital cameras are designed to produce colors that match those in the original scene. However, there is a lot of variation among sensors and among the circuits and software that process raw images into final photographs. The results you get depend, in part, on the accuracy with which you expose the image and how the camera handles color balance.

With film cameras, photographers usually explore a wide variety of films before settling on the one or two they like best. This is because each film type has it's own unique characteristics. In some the grain is small, in others it's larger. A film may have colors that are warmer than other films, or slightly colder. These subtle variations among films are what make photographers gravitate to one or the other. With digital cameras, you don't have the same choice offered by film cameras. The "film" in the form of an image sensor is built into your camera. Whatever its characteristics are, they are the characteristics you have to live with until you buy another camera.

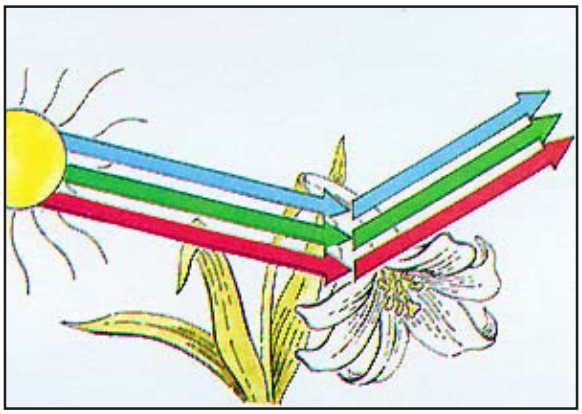
In this chapter, we explore the world of color and how you manage it in your photos.

Where Does Color Come From?

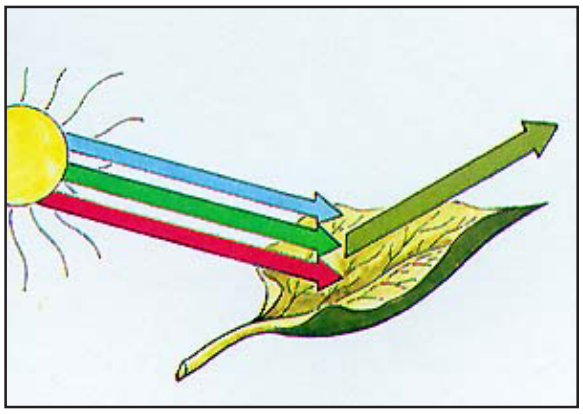
Why do we see colors? Light from the sun or from a lamp seems to have no particular color of its own. It appears simply to be "white" light. However, if you pass the light through a prism, you can see that it actually contains all colors, the same effect that occurs when water droplets in the atmosphere separate light into a rainbow. A colorful object such as a leaf appears green because when white light strikes it, the leaf reflects only the green wavelengths of light and absorbs the others. A white object such as a white flower appears white because it reflects most of the wavelengths that strike it, absorbing relatively few. Inks, dyes, or pigments in color prints also selectively absorb and reflect certain wavelengths of light and so produce the effect of color.



Although light from the sun appears colorless or "white," it actually contains a range of colors similar to a rainbow. You can see these colors using a prism to separate them out.



White objects reflect most of the wavelengths of light that strike them. When all of these wavelengths are combined, we see white. On the other hand, when all of them are absorbed, and none reflected, we see black.



A green object such as a leaf reflects only those wavelengths that create the visual effect of green. Other colors in the light are absorbed by the leaf.

White Balance and Color Temperature

TIPS

- Color temperature ranges from high temperature blues to low temperature reds. As color temperature increases it moves through the colors red, orange, yellow, white, and blue white in that order.
- If you shoot images in the RAW file format (page 20), you can adjust color balance on your computer after you shoot.

Although light from the sun or from a light bulb looks white to us, it not only contains a mixture of all colors, it contains these colors in varying proportions. Light from the midday sun, for example, is much bluer than light from a sunrise or a tungsten lamp. To produce what appears to us to be normal or accurate colors, the image we capture must contain the colors in the original scene as we see them. These colors are affected by the color of the light that illuminates them.

Images can be balanced to match light of a particular color temperature. This is done using a system called *white balance* that automatically or manually adjusts the image so it renders colors the way we see them regardless of the light illuminating them. The daylight setting compensates for the cooler, more bluish color of daylight. The tungsten setting compensates for the warmer, more reddish color of tungsten lights.

You can check color balance by looking at the captured image on the camera's monitor. If you examine the images closely you may notice that white areas in particular have some color cast to them. If so, you may want to adjust white balance for subsequent shots.

Counter clockwise from top, auto (AWB), daylight, shade, cloudy, tungsten, florescent, flash, and custom icons.

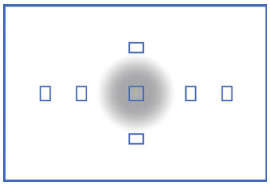
Using Preset White Balance Settings

The Digital Rebel offers seven white balance settings, each for a different lighting situation. When you select a mode in the Basic Zone auto white balance (AWB) is automatically selected, but for modes in the Creative Zone you can select any of the seven modes including Auto, or use the Custom setting for even greater control. The numbers in parentheses following each mode below indicate it's approximate color temperature in degrees Kelvin.

- **Auto** (AWB) automatically selects the white balance to match the current light source. Select another mode if this mode doesn't give you the results you want. (3000–7000 K)
- **Daylight** is best when photographing outdoors in sunlight. (5200 K)
- **Shade** is best when photographing in open shade. (7000 K)
- **Cloudy** is best when photographing outdoors in cloudy or overcast conditions. (6000 K)
- **Tungsten** is best when photographing indoors under incandescent lights. (3200 K)
- **Fluorescent** is best when photographing indoors under white fluorescent lights. (4000 K)
- **Flash** is best when photographing with flash. (6000 K)
- **Custom** (page 65) is best when other settings don't give you the results you want. (2000–10000 K)

TIPS

- If you like the warm glow of incandescent lights, you can capture it by setting white balance to daylight.
- You can save three custom settings (parameters) for color saturation and tone and then select any one of them for a specific situation. You can also select a color space to attach to your images (page 117).



The area of the viewfinder used for partial metering occupies only the central 9%.

The custom white balance icon.

QuickSteps SELECTING A WHITE BALANCE MODE

1. With the Mode Dial set to any mode in the Creative Zone, press and release the white balance (WB) button (the down cross key) and then turn the Main Dial to scroll through the available settings displayed on the LCD panel. (AWB is the default).
2. Press the shutter button halfway down to return to shooting mode.
3. When finished, repeat Step 1 to reset white balance to AWB (Auto) or the mode will be remembered even when you turn off the camera.

CREATING AND USING A CUSTOM WHITE BALANCE SETTING

If none of the preset color settings give you the results you want, you can create your own. You photograph a sheet of plain white paper with it filling the area in the viewfinder covered by partial metering, and then use that image to set white balance. This is useful when other settings don't give you the results you want. If you take pictures of a standard white object under various lighting and keep them on your CF card, you can select one at any time with the *Custom WB* command. This is a useful technique if you regularly shoot under more than one type of light. It's like having a library of custom settings.

QuickSteps SETTING A CUSTOM WHITE BALANCE

1. With the Mode Dial set to any mode in the Creative Zone, and white balance set to any setting, photograph a white subject that fills the 9% area in the viewfinder covered by partial metering. You may have to focus manually since the subject lacks contrast.
2. Press MENU, display the shooting tab, highlight *Custom WB*, and press SET to display the image you took in Step 1 and the prompt *Select an image*.
3. Press SET to use the image to set white balance, or turn the Main Dial to display another picture first.
4. Press the MENU or shutter button to exit the menu,
5. Select the icon for custom white balance using the steps in the QuickSteps box "Selecting a White Balance Mode."
6. When finished taking pictures, reset the white balance mode to auto.

USING WHITE BALANCE BRACKETING

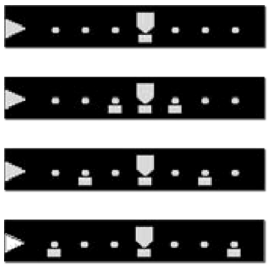
You can use white balance bracketing to have a single image processed with three different white balances. You first set the white balance you want to use and then specify how large the changes in the other two versions should be. You can specify up to + or – 3 stops in whole-stop increments and each stop is equivalent to 5 Mireds of a color conversion filter. The first version is captured at the set color balance and the other two are made more bluish (decreased compensation) and reddish (increased compensation).

You can combine white balance bracketing with exposure bracketing (page 42), but you will get 9 images in each series.

The effects of color balance are most obvious in the early morning and late evening when the sunrise or sunset often changes the color of everything you see.

TIP

When white balance bracketing is in effect the current white balance icon on the LCD panel blinks and the remaining pictures readout shows only one-third the number of images it would normally show.



As shown here from top to bottom, the bracketing amount can be set to 0 (off) or 1, 2, 3 stops.

QuickSteps USING WHITE BALANCE BRACKETING

1. With the Mode Dial set to any mode in the Creative Zone, and the image quality not set to RAW, press MENU and select the shooting menu tab.
2. Highlight *WB-BKT* and press SET to activate the bracketing scale.
3. Turn the Main Dial to expand or contract the change in color temperature between shots and press SET. Three small bars under the scale indicate what the color temperature will be for each of the three shots. The middle bar is at the color temperature recommended by the camera and the left and right bars indicate by how many stops color temperature is decreased (bluish) and increased (reddish).
4. Press the MENU or shutter button to exit the menu and take one photo. While it is being processed into the three pictures in the series you cannot take another picture.
5. When finished, repeat Steps 1–3 to reset *WB-BKT* to 0. If you don't every shot you take will be bracketed until you turn off the camera.

Color Balance and Time of Day

In photography, there is a color of light called "daylight." However, this type of light occurs only on clear days. Over the course of the day, the light can change from a warm red at sunrise, to a cold blue at noon, and then back to a warm red or orange at sunset. "Daylight" on the color temperature scale is really set for a clear midday between 10 A.M. and 2 P.M. During these hours, colors appear clear, bright, and accurately rendered in a photo.

Before and after midday, light from the sun is modified by the extra distance it travels through the Earth's atmosphere. Some of the blue light is filtered out, leaving the light with a more reddish cast than at midday. This is easily seen very early or late in the day when the light is often quite red-orange in tone. The change in color will affect your pictures strongly, but this reddish cast is a wonderful light to photograph in.

Just before dawn and at dusk, colors often appear muted or monochromatic. During these hours when light is relatively dim, you often have to use an extra-long exposure time.

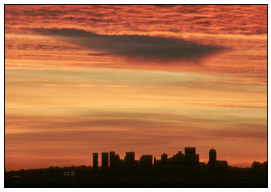
Midday light on a sunny day will produce colors that appear natural and accurately rendered.

Early morning and late afternoon light produce a more reddish color balance than you get at midday.

Sunsets and Sunrises

Sunsets and sunrises are relatively easy to photograph because the exposure is not as critical as it is with some other scenes. If you underexpose the scene slightly, the colors will simply be a bit richer and darker. Slight overexposure will make the same scene slightly lighter.

The sun often takes on a flattened appearance as it rises above the horizon. When partially obscured and softened by a haze, its warm, red glow illuminates the foreground.



Sunrises and sunsets by themselves aren't very interesting. It's objects in the foreground, such as a skyline, or unusual atmospheric effects such as this dark cloud that give them some punch.

The colors in the sky are often richest in the half hour before the sun rises and the half hour after it sets. It pays to be patient as you watch the sky change during these periods. For one thing, the sun itself is below the horizon and not in the image so exposure problems are greatly reduced. Also, clouds in the sky often light up dramatically and in some cases, reflect the light to other clouds until you find yourself under a wonderful canopy of reflected color.

Every sunrise and sunset is unique and the variations can be truly amazing. It's certainly not true that "if you've seen one sunrise or sunset, you've seen them all." If you want the sun in the photo, it's best if it is softened and partly obscured by a mist or haze. If it rises as a hot white or yellow ball, find another subject, or turn around and photograph the scene it's illuminating.

With the bright disk of the sun included in a sunset or sunrise, your picture may come out somewhat underexposed and darker than you expect it to be. Add 1 or 2 stops of exposure to a sunset or sunrise that includes the disk of the sun.

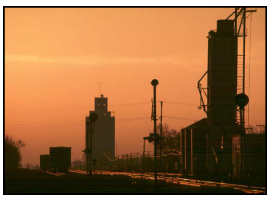
WARNING!

Never look at the bright sun through the viewfinder. You can seriously damage your eyes.

It's tempting to take all of your photos of a rising or setting sun, but it often pays to turn around. The rich, warm light changes the colors of everything it hits. This is a magic time to capture images that will really stand out. Colors take on a warm, soft glow that can't be found at any other time of the day.

Instead of shooting into the sun at sunrise or sunset, shoot with it behind you to capture rich, warm colors of scenes bathed in the sun's light.

A long-focal-length lens enlarges the disk of the sun so that it becomes a more important part of the picture. Foreground objects silhouetted against the bright sky, can also add interest.



Here the camera was positioned so the rising sun was behind one of the grain elevators where it wouldn't burn out the image with its glare.

ANTICIPATING THE SUN AND MOON

When planning to integrate the sun or moon into an image it helps to know when it rises or sets and what phase the moon is. This information is available in almanacs and on the Web at the U.S. Naval Observatory (http://www.usno.navy.mil).

Weather

There's no need to leave your camera home just because the sun hasn't come out. In fact, rain, snow, fog, and mist can add interest to your pictures. Objects at a distance often appear diffused and gray in such weather, with foreground objects brighter than normal because they are seen against a muted background. Remember to take a little extra care in bad weather to protect your camera against excessive moisture.

Snow covered scenes are not only beautiful to look at, they make great photographs.

A light fog subdues colors and softens objects in the background.

TIP

An LCD display typically reacts more slowly when it's cold and may look darker when it's hot. It will return to normal when the temperature does.

CAMERA CARE

In cold weather, batteries run down a lot faster. To prevent this from happening, carry the camera under your coat or remove the battery from the camera and carry it in a warm pocket until you need it.

Rainbows always make good pictures. The problem is, you rarely find them where you want them, when you want them. To get better at capturing them, you should know something about how rainbows form so you can anticipate them. Rainbows are formed by sunlight being refracted by raindrops. You'll usually find the combination of rain and sun at the leading or trailing edge of a summer storm. You can't see rainbows at all times of the day. To understand why, visualize the way the rainbow works. If you stand with your back to the sun while looking at a rainbow, imagine a line from the sun passing through your eye, through the Earth, and out into space. (This is called the antisolar point.) The rainbow forms a complete circle around this imaginary line, although part of it is always below the horizon. A line drawn from your eye to the top of the rainbow forms a 42-degree angle with the imaginary line from the sun through your eye. (If there is a secondary rainbow, it forms an angle of 51-degrees.) Because these angles determine the position of the rainbow in the sky, it will sink as the sun rises and rise as the sun sinks. When the sun is high in the sky, the entire rainbow, not just the bottom part, will be below the horizon where you can't see it. That's why you'll never see a summer rainbow at midday.

From a plane you can sometimes see all 360 degrees of a rainbow. Here you see a section of one shot through an airliner window. To the right of the brighter primary rainbow is a dimmer secondary one.

A very light mist can dim the sun enough to include it in a photograph. If it weren't partially obscured by the fog, it would appear as a white dot against a very dark background.

Photographing at Night

You can photograph many different things outdoors at night, so don't put your camera away just because the sun is gone for the day. Light sources (street lights, automobile lights, neon signs, or fires) or brightly lit areas (illuminated buildings or areas under street lights) will dominate pictures at night because they stand out strongly against darker backgrounds. Plan to use these bright areas as the dominant part of your picture. A tripod will support your camera during long exposures and prevent blur caused by camera motion during the time the shutter is open.

This exterior of the Paris Opera House was shot at night with just illumination from spotlights.

Fireworks can be dramatic, but are difficult to capture. You need to experiment and a digital camera is perfect for that because you can instantly review your results.

To capture interesting images of fireworks, put people or water in the foreground. It also helps if there are identifiable objects in the image such as an illuminated building or monument to give the viewer a sense of place. Get upwind from the show since fireworks generate a lot of smoke that can become a problem if you are downwind. If you are upwind, the smoke will become part of the image, illuminated by the fireworks. Automatic exposure doesn't work well with fireworks. Set your exposure for fireworks by switching to Av (aperture-priority) or Tv (shutter-priority) mode and try for a setting of f/2.5 at 1/30 second. Try a series of exposures of different bursts because there is a certain amount of luck involved. If there are foreground figures you might try fill flash (page 97) or Night Portrait mode (page 24).

TIP

If the camera has trouble focusing, switch to manual focus, or pop-up the flash so it can strobe to assist focus. (It does this automatically in most Basic Zone modes.)

You might also want to try increasing sensitivity, use exposure compensation, and try different combinations of aperture and shutter speed as well as those recommended here. Finally, for really interesting effects, you might switch to manual exposure and use the bulb setting (page 73) to capture multiple bursts. You might also explore using Program AE and shifting the program to get the slowest possible shutter speed (page 25).

The moon, especially when full, adds a lot to an image. The best time to capture the moon is when it's near the horizon. Because it is close to foreground objects at that time, it looks much larger than when it's higher in the sky.

Keep in mind that the moon is relatively dim and usually requires long exposures. Since it's moving relative to the Earth, longer exposures can

TIPS

- You might want to switch to Tv (shutter-priority) mode so you can use shutter speeds as slow as 30 seconds (page 27) or M (manual) mode and use the bulb setting.
- in bulb mode you can press the transmit button on the wireless remote control RC-5 once to open the shutter and again to close it.

actually blur it, giving it a slightly oblong shape. To reduce the chances of this happening, shoot just before sunrise or just after sunset when there is still some light in the atmosphere from the recently set sun. (It bends around the Earth's curvature due to refraction in the atmosphere.)

Try Night Portrait mode when photographing people at twilight, night, or dawn. It illuminates foreground subjects with the flash and the shutter speed is set slow enough to lighten the background. This mode is especially good for outdoor shots with foreground subjects. Since a slow shutter speed may be used in this mode, you may need to support the camera (page 47).

To get exposures at night, you can use the bulb setting. Bulb makes it possible to capture multiple bursts of fireworks, light trails from moving cars and star trails as the Earth rotates under a canopy of stars. When in this mode, the shutter will remain open up to 2.5 hours (the timer goes to 999 seconds) as long as you hold down the shutter button and moving lights paint lines in the image. To avoid blur from camera shake, you must use a tripod or other secure support. It can be tiring to hold the shutter button down, and hard to keep from moving the camera. It is much easier to use the remote switch RS-60E3 to lock the shutter open for long exposures. Keep in mind that when using bulb, you can't see through the viewfinder while the exposure is being made. Also long exposures add noise to an image.

The Av/Exposure compensation button icon.

You can press the button on the back of the camera marked with this icon to illuminate the LCD panel so it's readable in the dark. The light will turn off when you press the shutter button halfway down.

QuickSteps USING BULB EXPOSURES

1. Set the Mode Dial to M (manual).
2. Turn the Main Dial by itself to select *buLb*, then hold down the Av/Exposure Compensation button as you turn the Main Dial to select an aperture.
3. Press and hold down the shutter button for as long as you wish. A timer is displayed on the LCD panel to guide you and counts up to 999 seconds. However, with a full battery, you can keep the shutter open about 2.5 hours.

The rising full moon, and the trail it leaves across the water, adds a lot to this photo of an old-fashioned coal-burning power plant on Salem Harbor.

The Direction of Light

The direction that light comes from relative to your camera's position is important because it affects the shadows that will be visible in your picture. It can also affect your exposure. Backlighting, for example, can have your subject silhouetted against a background so bright that your automatic exposure system will underexpose the scene and make the subject even darker. This is fine if you want a silhouette. If you don't, you should use exposure compensation to lighten the image.

Four main types of lighting are illustrated here: front-lighting, side-lighting, backlighting, and top-lighting. Notice the position of the shadows in these photographs and how they affect the subjects.

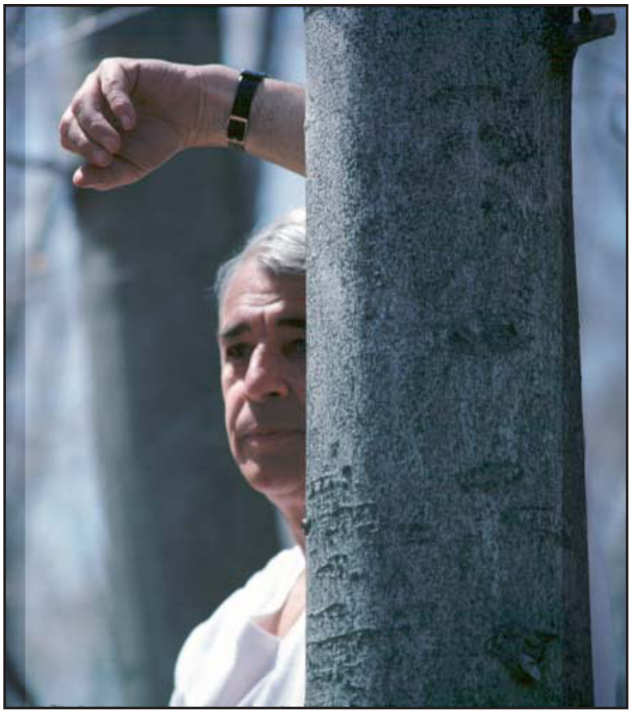
Side-lighting increases the sense of texture and volume because it casts shadows visible from the camera's position. Landscape photographers often prefer to work early in the morning or late in the day because the low sun sidelights scenes and adds interesting surface textures.

Front-lighting decreases visible shadows and minimizes surface details as well as the apparent depth or volume of the subject

Backlighting puts the side of the subject that is facing the camera in shade. Automatic exposure tends to make backlit scenes too dark. You can add exposure to lighten the picture, especially those parts that are in shade.

TIP

In the Basic Zone modes other than Landscape, Sports, and Flash Off, the built-in flash will pop up and fire automatically in backlit conditions.



Top-lighting that comes from overhead can occur outdoors at midday or indoors where ceiling lights predominate. If you are photographing a person, you will notice that top-lighting tends to cast shadows in eye-sockets and illuminate the top of the nose brightly. To avoid this effect, you might try moving the person into the shade.

Top-lighting, such as that found at midday, can selectively illuminate things, such as this flag in the man's back pocket, that would be in shadow with light coming from a lower angle.

The Quality of Light

Light not only has direction, it can be direct or diffused. Direct light that comes mainly from one direction produces relatively high contrast between bright highlights and dark shadows. Diffused light bounces onto the subject from several directions, lowering contrast. Contrast, in turn, affects the brilliance of colors, the amount of visible texture and detail, and other visual characteristics.

In direct light you may have to choose whether you want highlights or shadows to be correctly rendered because image sensors can accurately record only a limited range of contrast between light and dark areas. If this creates a problem because both highlights and shadowed areas are important, you can sometimes add fill light to lighten shadows and decrease contrast or adjust the contrast setting (page 117). In diffused light, colors tend to be softer than in direct light and textures are also softened because shadow edges are indistinct.

Direct light comes from a point source, such as the sun on a clear day. It produces dark, hard-edged shadows that crisply outline details. Here the light and shadows almost form an abstraction.

Diffused light comes from a light source that is so large relative to the subject that it illuminates from several directions. On an hazy or overcast day, illumination comes from the entire dome of the sky, not from the brighter, but smaller, sun. Indoors, light bounced into an umbrella reflector or onto a wall or ceiling creates a broad source of light that wraps around the subject.

Chapter 5
Understanding Lenses

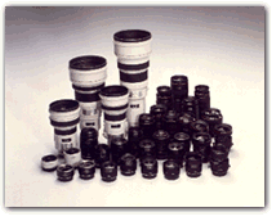
CONTENTS

■ Canon Lenses ■ Zoom Lenses ■ Normal Lenses ■ Wide-Angle Lenses ■ Telephoto Lenses ■ Tilt-Shift Lenses ■ Lens Accessories ■ How a Photograph Shows Depth

The Canon Digital Rebel is one of the first affordable digital cameras that lets you draw from a vast array of interchangeable lenses. These range from fish-eye lenses for extreme wide-angle shots, to lenses that will capture an athlete's expression across the width of a football field. If you're new to photography, you'll be amazed at the difference high-quality interchangeable lenses can make. If you are an experienced digital photographer with a background in SLR cameras, you'll just say "It's about time."

A favorite lens of many photographers is a high quality zoom lens that lets you quickly zoom in or out to meet different photographic opportunities. Zoom in on a subject and you can capture distant action at sporting events or in the field. Zoom out and you can capture a wide-angle view of a large group, a roomy interior, or of an expansive landscape. The ability to change your angle of view as you frame your image is one of your most powerful creative controls. But there are a lot more lenses to choose from. They include macro lenses, tilt-shift lenses, and even soft focus lenses.

CANON LENSES



If you have the money, Canon has the lens.

The Digital Rebel can be purchased with the EF-S 18-55mm lens.

The lens release button.

One of the best things about the Digital Rebel is that it can use any one of the 50 or so EF lenses from the Canon line. Even better, if you have a 35mm EOS camera you can switch your lenses between film and digital cameras.

Canon designed a zoom lens specifically for the Digital Rebel. The EF-S has a focal length of 18-55mm (28-90mm on a 35mm film camera) and a maximum aperture range of f/3.5-5.6. The smaller size of the image sensor means the camera's reflex mirror can also be smaller, making it possible to bring the back of the lens closer to the image sensor. The 'S' in the EF-S nomenclature stands for 'short back focus', which describes this new system. Manufacturing costs associated with such a wide-angle zoom lens would normally be very high. The 'short back focus' system of the Digital Rebel, however, has allowed Canon's design engineers to develop a remarkably low-weight, short-length lens that retains all the high-quality hallmarks of the EF range. The result is an opportunity for Digital Rebel users to work with a lens that would normally carry a prohibitively expensive price tag.

While the Digital rebel is compatible with the more than 60 EF lenses, the EF-S 18-55mm lens has a new mount in the EF lens series which fits only the Digital Rebel. A white lens mount index (in addition to the traditional red marking) differentiates the lens from other EF lenses and a rear rubber ring prevents any damage in the event that an inadvertent attempt is made to mount the EF-S lens on a camera other than the Digital rebel.

QuickSteps MOUNTING AND UNMOUNTING A LENS

1. Twist the rear lens cap counterclockwise until it stops, then lift it up to remove it. Remove any body cap from the camera the same way.
2. Do one of the following:
   - If using the EF-S 18-55m lens designed specifically for the Digital Rebel, align the white index mark on the lens with the white index mark above the camera mount on the camera body.
   - If using any other Canon lens align the red dot on the lens with the red dot above the camera mount on the camera body.
3. Insert the lens into the mount and turn it clockwise (as you face the lens) until it clicks into place. Gently try to turn the lens in the other direction to ensure that it's securely locked in place.
4. To remove the lens, press the lens release button and turn the lens counterclockwise so the index mark is at the top, then remove it.

ELECTRONIC LENS MOUNT

The Canon family of EF (Electronic Focus) lenses was introduced with the first EOS camera in 1987. Instead of mechanical linkages, all communication between the lens and the camera passes through electrical contacts. These circuits provide the power needed by a small motor in the lens that controls autofocus and the electromagnetic diaphragm (EMD) that controls aperture settings. This electronic system is much more accurate, reliable, and flexible than older mechanical linkages.

On some zoom lenses, setting the distance limiter switch to FULL lets the lens try to focus over it's entire range. When set to LIMIT, it will only focus at a specific range of distances.

FOCUSING TECHNOLOGY

Canon EF lenses have a focus switch that let's you select autofocus (AF) or manual focus (M on older lenses and MF on newer ones). When set to M or MF you focus by turning the focus ring on the lens. On lenses with full-time manual focus, you can use this focus ring even when the focus switch is set to AF. This let's you override the autofocus system to "fine-tune" the focus without having to look up from the viewfinder to find the focus switch to change modes. Full-time manual focus comes in two versions. Electronic manual focusing detects how much you've turned the focus ring and then uses the focusing motor to focus the lens by the same amount. Mechanical manual focusing adjusts the focus manually as you turn the focus ring.

As the lens focuses, it uses one of five different focusing methods that include the following:

- Overall extension where the entire optical system moves forward or backward.
- Front group extension where only the front-most lens group moves forward or backward.
- Front group rotation extension, used only in zoom lenses, where the front-most lens group rotates as it moves forward or backward.
- Inner focusing where only the lens group between the front lens and the aperture diaphragm is moved.
- Rear focusing when only the lens group behind the aperture diaphragm is moved.

Some lenses have a focus preset feature so you can store the desired focusing distance in memory and later instantly focus the lens at that distance. With one distance set in memory you can focus elsewhere and then instantly return to the prefocus distance. This is ideal in sports and nature photography where you are monitoring action at a specific point such as a nest or goal, but where you also want to capture other action.

A few lenses have an AF stop feature that prevents focus from shifting when something passes between you and the subject you're focused on. You turn this feature on by pressing an AF Stop button on the lens.

ULTRASONIC MOTORS

Since electronically coupled lenses need to move lens groups to focus the image, Canon had to develop small, light, and powerful motors that fit inside the lens. One of their most impressive is the Ultrasonic Motor (USM). Unlike traditional motors that use a magnetic field to rotate an armature, these motors use ultrasonic vibrational forces to rotate a ring. The motor contains two rings; one that is fixed and one that rotates. As electricity is applied to piezoelectric ceramic elements on the fixed ring, the ring generates ultrasonic vibrations. These vibrations rotate the movable ring with significant force. The result is a motor that is fast, reliable, accurate and almost silent.

The EF 600mm f/4L IS USM Lens uses image stabilization for added steadiness and sharpness when working with a monopod at slower shutter speeds.

IMAGE STABILIZATION

If you've ever photographed in dim light, or tried to hand-hold a long telephoto lens, you know how easy it is to get blur in your images from camera shake. In most cases, we resort to tripods or other camera supports. However, Canon has introduced a new way; image stabilization (IS). Lenses

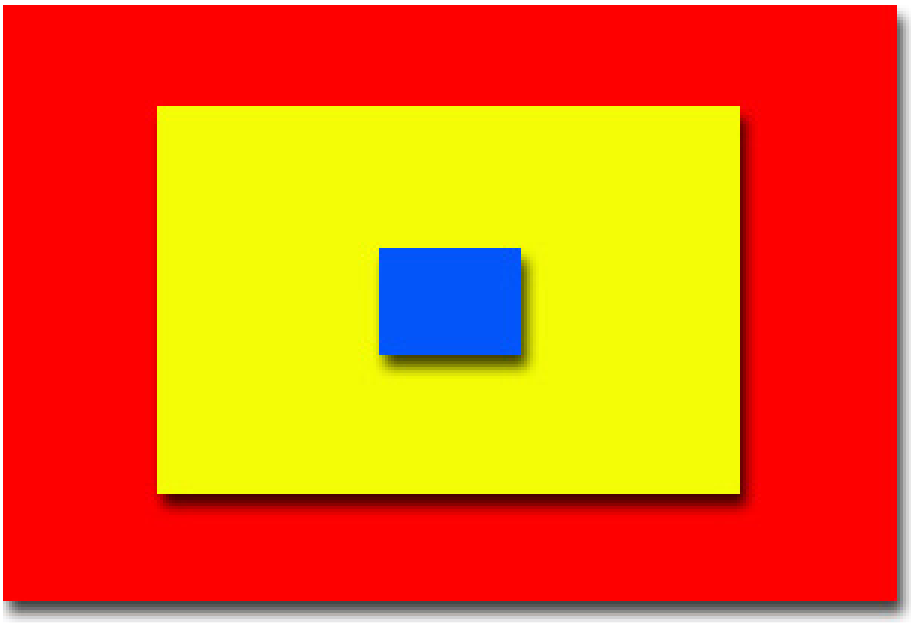
with this feature contain gyro sensors that sense movement of the lens and micro-motors that instantly shift a special image stabilization lens group to compensate for the motion and keep the image steady on the sensor. These lenses break the old rule that you should never hand hold a lens using a shutter speed slower than the reciprocal of the lens focal length. For example, when using a standard 125mm lens, you normally shouldn't use a shutter speed slower that 1/125. Image stabilized lenses let you add two stops to that calculation. You can hand hold an image stabilized 125mm lens at 1/30 of a second shutter speeds.

Note that when using an image stabilized lens on a tripod, you should turn off image stabilization. If you don't, you can actually add blur to the image. (A few lenses have a mechanism that prevents this problem.) This is because when image stabilization is on, the special image stabilization lens group is free to move. If it moves or vibrates while everything else is perfectly stable, blur results. When image stabilization is off, the image stabilization lens group is locked in place so it can't move.

Some Canon lenses have two IS modes. IS Mode-1 works for normal shooting and IS Mode-2 stabilizes the viewfinder image as you pan the camera to follow a moving subject.

FOCAL LENGTHS

Lens focal lengths are based on the physical characteristics of a lens so they are absolute values. However, a given focal length lens may have an "effective" focal length on one camera that's different from its effective focal length on another camera. This is because the effective focal length depends on the size of the film or image sensor being used. As these get smaller, a given focal length lens magnifies the scene more.



On the Digital Rebel the CMOS sensor (medium sized rectangle) has an area of 22.7 x 15.1mm in comparison with the 36 x 24mm image size of a 35mm film camera (largest rectangle). The smallest rectangle shows how small some other digital camera image sensors are.

Since the Digital Rebel's sensor is smaller than a frame of 35mm film, it essentially captures only the central section of the focused image. As a result, the effective focal length increases by a factor of 1.6 times compared to the indicated focal length of the lens. This multiple works across the entire range of focal lengths, making wide-angle lens less so on the Digital Rebel than on 35mm EOS cameras, and making telephoto lenses more so.

A lens projects a circle of light and the size of the film or image sensor determines how large an area of the circle is captured. The Digital Rebel (smaller frame) captures a smaller area than a 35 mm does (larger frame).

The tripod collar supplied with some lenses lets you mount the lens, rather than the camera, to a tripod. With longer lenses in particular, this provides a much better balance point for the combined weight of the camera body and lens. You can also rotate the lens within the mount without having to swing the tripod head to one side or the other.

UNDERSTANDING CANON LENS TERMINOLOGY

When you look at Canon lenses, or read about them, you may be confused at first by all of the information cryptically provided in the lens's name. Here is what each of the terms or abbreviations refers to.

EF—The lens is one of the EF (electronic focus) family of lenses that works with the Digital Rebel and with any EOS SLR, Advanced Photo System EOS SLR, and any camcorder with a VL mount.

28–105mm—The lens's focal length or zoom range in millimeters. You have to multiply this by 1.6 to know what its focal length or zoom range is when used with the Digital Rebel.

f/2.8—The maximum aperture that you can use with the lens. Generally, the larger the maximum aperture the heavier and more expensive the lens is. On a zoom lens, two apertures are given because the aperture changes as you zoom the lens in and out.

L—An indication that the lens is of especially high professional (or Luxury) quality.

USM—The lens features an ultrasonic motor.

II—The Roman numeral indicates that the lens has been revised or improved upon from an earlier version.

IS—The lens has image stabilization built in.

TE-S—The lens is a tilt-shift lens used for perspective and depth of field control.

Macro—The lens is designed for close-up photography.

DO—Diffractive Optical Element.

S—Short back focus. (Used on 18-55mm lens available with the camera.)

ZOOM LENSES

QuickSteps
ZOOMING A LENS

To zoom a lens, turn the zoom ring on the lens one way to zoom in and the other way to zoom out.

A zoom lens lets you choose any focal length within the range the lens is designed for. When you change focal lengths by zooming the lens, two important effects are immediately obvious in the lens' angle of view and its magnifying power.

Angle of view refers to how much of a scene the lens covers. Zoomed out, you have a wide-angle of view that captures a wide expanse of a scene. As you zoom in, the field of view narrows and you can isolate small portions of the scene without moving closer to the subject.

Magnification is related to the lens' angle of view. Since zooming out includes a wide sweep of the scene, all of the objects in the scene are reduced to fit into the image. Zooming in gives a much narrower angle of view, so objects in a scene appear larger.

Canon has a wide variety of zoom lenses covering various focal length ranges between 16mm and 400mm (26mm to 640mm on the Digital Rebel). When using a zoom lens keep these points in mind:

- When using autofocus, don't turn the focusing ring on the lens.
- If you want to zoom, do it before focusing. Turning the zoom ring after achieving focus may throw off the focus.

Zooming a lens is like walking toward or away from the scene. Here, a lighthouse in Maine is photographed a number of times from the same spot. The images vary from wide-angle to telephoto.

The Digital Rebel can be purchased with the EF-S 18-55mm lens. This lens has an aperture range of f/3.5-5.6 and has a focal length equivalent to a 29-88mm lens on a 35mm film camera. This lens cannot be used on other Canon cameras.

Normal Lenses

Canon's EF 50mm f/1.0L USM lens has an extremely fast maximum aperture of f/1.0.

A "normal lens" for a 35mm camera usually refers to a lens with a 50mm focal length. On the Digital Rebel, an equivalent lens will have focal length of about 35mm because its image sensor is smaller than 35 mm film. One of the reasons these lenses are called "normal" is because they capture perspective much the way your unaided eye does.

A normal-focal-length (50mm) lens isn't necessarily the one photographers normally like to use. Many photographers prefer a zoom lens or the wider angle of view and greater depth of field provided by a shorter focal length.

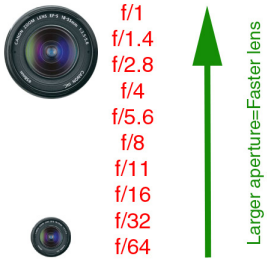
It's hard to look at a photo and tell what focal-length lens was used to take it. However, objects in an image taken with a normal lens look normal in their spatial relationships.

MAXIMUM APERTURES

All lenses are marked with their maximum aperture—how wide the lens will open. It's listed on the lens as a ratio such as 1:2.4 or 1:3.5–5.6. A larger maximum aperture is better because it lets you use a smaller aperture for more depth of field, a faster shutter speed to freeze action, and a greater range for your flash.

A lens with a maximum aperture of f/1.4 is three stops faster than a lens with a maximum aperture of f/5.6. (See the list of standard apertures to the left.) This means that instead of using a shutter speed of 1/15 you can use one of 1/125. The problem with lenses having large maximum apertures is that they are expensive, large, and heavy. For example, a Cannon 400mm lens with a f/5.6 maximum aperture weighs about 3 pounds and costs about $1000. A 400mm lens with a maximum aperture of f/2.8, just two stops faster, weighs almost 12 pounds and costs over $6000.

A lens' *maximum aperture* is determined by dividing the actual diameter of the aperture opening into the focal length of the lens. That's why the aperture on a zoom lens changes as the lens is zoomed in and out to change the focal length.



Lenses with larger maximum apertures let you use faster shutter speeds and are often called "faster" lenses.

WIDE-ANGLE LENSES

Wide-angle (short focal length) lenses capture a wide expanse of a scene. This wide angle of view is ideal for use in tight spaces, when photographing landscapes, and in small rooms where you can't position the camera a great distance from the subject.

A wide-angle lens is good for indoor portraits where including the setting is important.

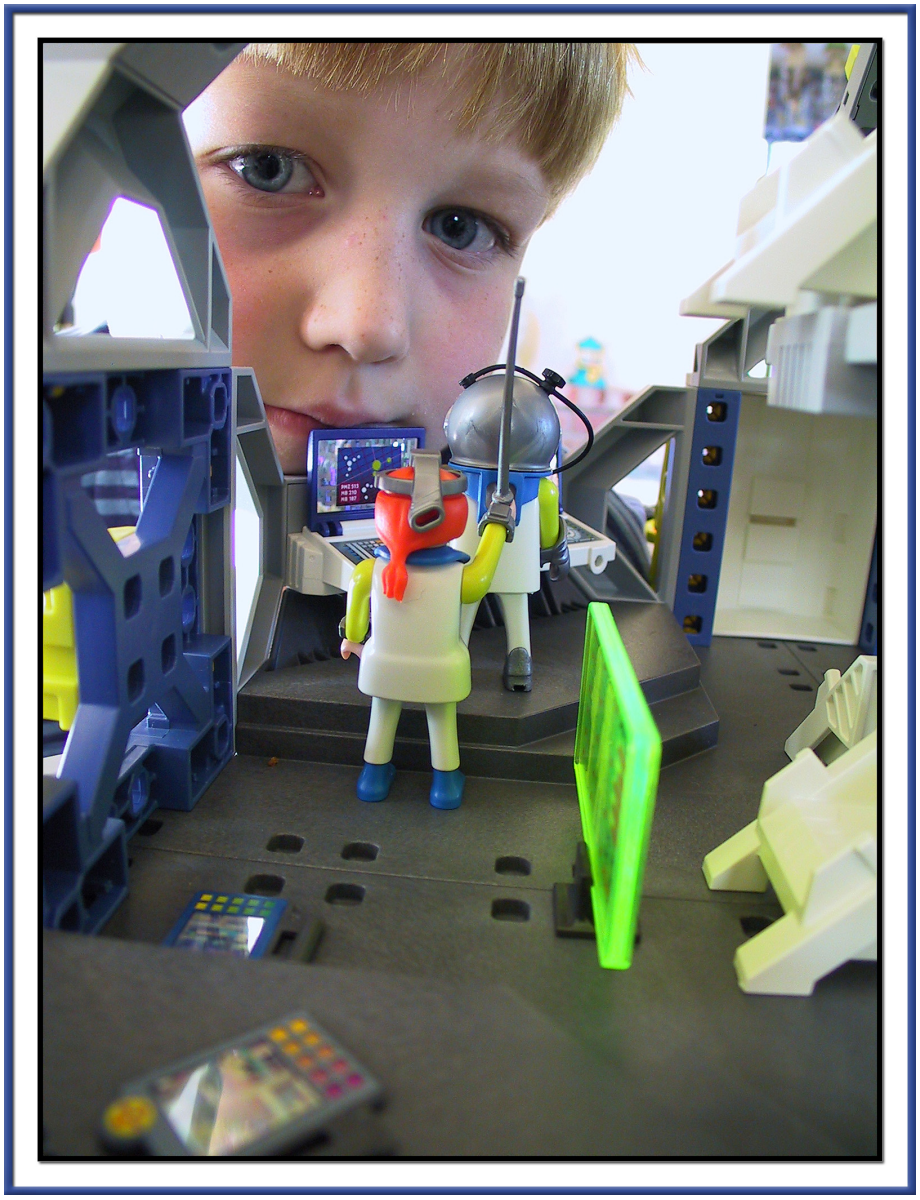
The 17-35mm lens is a wide-angle zoom. It's 27-56mm on the Digital Rebel.

A wide-angle lens also has great depth of field that make them ideal for street or action photographs. When out to capture quickly unfolding scenes, you can also use zone focusing (page 59) so you'll have maximum depth of field when you respond quickly to a photo opportunity.

Wide-angle lenses are ideal when you need great depth of field because part of the scene is close to the camera and part farther away. It also makes focusing less critical so you can capture those fleeting moments you might otherwise miss.

Short lenses also let you focus very close to your subject, and the effect this can have on the perspective in your images can be dramatic. Objects very close to the camera loom much larger than those farther away. This distortion in the apparent size of objects can deliberately give emphasis and when carried to an extreme will give an unrealistic appearance to a scene.

Wide-angle lenses have tremendous depth of field. Here one was used to shoot through a toy space station and makes Quinlan look like a giant.



A 15mm fisheye lens is 24mm on a Digital Rebel. It gives a circular "fisheye" look to images.

A 14mm wide-angle lens is 22mm on a Digital Rebel. It's a rectilinear lens so its images don't have the distorted look of some fisheye lenses.

TELEPHOTO LENSES

Telephoto lenses come in fixed focal lengths and as zooms. This 35–350mm zoom has a focal length range on the Digital Rebel of 56–560mm.

A telephoto (long focal length) lens acts somewhat like a telescope: It magnifies the image of your subject. This is especially useful when you can't get close to your subject—or don't want to. These lenses are ideal for wildlife, portrait, and candid photography, whenever getting close to a subject might disturb it.

As the focal length increases, depth of field gets shallower so you must focus more carefully. Also, a long lens visually compresses space, making objects in the scene appear closer together than they actually are (page 90).

The primary drawback of longer lenses is that they often have smaller maximum apertures that require longer shutter speeds. Also, since a long lens magnifies movement, just as it magnifies the subject, you may have to support the camera better to get maximum sharpness.

Zooming in makes distant objects appear compressed. Here a long lens has been used to "compress" a street scene at the foot of the Rocky Mountains in Colorado.

A long lens makes the sun look larger in relation to foreground objects.

When the lineup of cement trucks (bottom) is shot head-on with a long lens (top) they appear much closer together then they really are. This is actually due to the distance from the subject, not the focal length of the lens, but the effect is easy to get with a long lens.

Portraits with a Telephoto Lens

A telephoto lens is an excellent portrait lens, especially for head-and-shoulders portraits. It lets you keep your distance and still fill the viewfinder frame with the subject. Keeping at a distance eliminates the exaggerated perspective caused by working very close to a subject with a shorter focal length lens. It also helps relax your subjects if they get uneasy, as many people do, when a camera comes close.

A long lens lets you get portraits without crowding in on the subject. This let's you capture more natural expressions.

Using a wide-angle lens close to the subject adds some distortion to the portrait but it still works as an image. Perhaps not as flattering as it might be, the image is probably more interesting to others than to the subject.

Extenders fit between the lens and camera body to increase focal lengths by 1.4x or 2x.

You can extend the focal length of some lenses using an extender, an optical device that mounts between the lens and camera body. With the Digital Rebel, you can use both 1.4x II and 2.4x II extenders. The 1.4x extender requires you to open up one stop and the 2x requires 2 stops. In some cases you may have to focus manually.

TILT-SHIFT LENSES

A Canon TS-E lens.

Tilt-shift lenses serve two very important purposes. The tilt controls depth of field and the shift controls the way vertical lines appear in the image. Until Canon developed these kinds of lenses, their effects could only be achieved on a large format camera. The lenses charge a small penalty for all of their flexibility. They can cause metering errors and require you to open up one or two stops.

■ Tilting the lens allows you to control depth of field in an image without changing the aperture. Normally a lens is parallel to the image sensor. To change the depth of field for a given subject and camera position you have to open or close the aperture. With a lens that tilts from side to side or top to bottom, the plane of critical focus can be tilted one way to dramatically increase depth of field or the other way to dramatically decrease it. This makes it possible to use a wide aperture and still get great depth of field. The larger aperture allows faster shutter speeds so you can capture scenes you might have missed before, such as a field with flowers blowing in the wind.

A bubble level that slips into the hot shoe assures you that the camera is perfectly level when using the camera's shift control. This is the BI2 from Kaiden.

■ Shifting the lens helps you correct for converging vertical lines that occur when you tilt the camera to capture trees, buildings, or other tall subjects. These lines converge in the image whenever the camera is tilted and the image sensor is no longer parallel to the subject. Using the lens' shift function, the lens can be shifted upward to eliminate the foreground while keeping the image sensor parallel to the subject.

■ You can create panoramic images by taking two photos with the lens shifted in opposite directions.

■ When photographing reflective subjects, you can eliminate your reflection by moving the camera to a position where the reflection doesn't show, and then shifting the lens to center the subject in the picture area. The same technique can be used to eliminate unwanted subjects in the foreground.

Canon has three Tilt-Shift (TS-E) lens in different focal lengths. All three can rotate 90 degrees, be tilted +/-8 degrees, and be shifted +/-11 mm. On the 24 mm lens, some of the shift and tilt ranges are marked in red because images may be vignetted if shifted or tilted into these zones on a 35mm camera. This happens because the lens focuses a circle of light on the image plane and as you tilt and shift, the film captures different parts of the circle. However, on the Digital Rebel the image sensor is smaller so the lens can be shifted and tilted farther without vignetting.

The house on the left, shot by pointing the camera up to get in the entire house, has converging vertical lines and looks tilted. In the photo on the right taken with the lens shifted, the house looks rectangular and all vertical lines are parallel.

Lens Accessories

TIP

It's usually recommended that you only use only one filter at a time or you may get vignetting.

Many Canon lens have threads into which you can screw filters and other accessories. Here are just some of the accessories you should consider.

- Lens hoods protect the front element from bumps and keep stray light from striking the front of the lens and causing flare or ghost images.
- Caps protect the front and rear of the lens when it's not in use. A body cap protects the camera when no lens is attached.
- Protect filters keep the front element of your lens from getting scratched or dirty.
- Circular polarizing filters remove reflections from glass, water, and other reflective surfaces, darken blue skies, and improve color saturation. If you use a linear polarizing filter, you can't use autofocus.
- Skylight filters reduce the blue casts you often get when photographing subjects in the shade on sunny days.
- UV filters absorb ultraviolet light and cut the haze when photographing landscapes or from airplanes.
- Neutral density filters cut the light entering the camera so you can use slower shutter speeds or wider apertures in bright light.
- Soft focus filters soften the focus to make portraits more flattering and to make hazy, romantic landscapes.
- Close-up lenses magnify the subject without affecting aperture settings.
- Color conversion filters let you fine-tune the way you capture colors.

Lens hoods protect the front element and reduce lens flare.

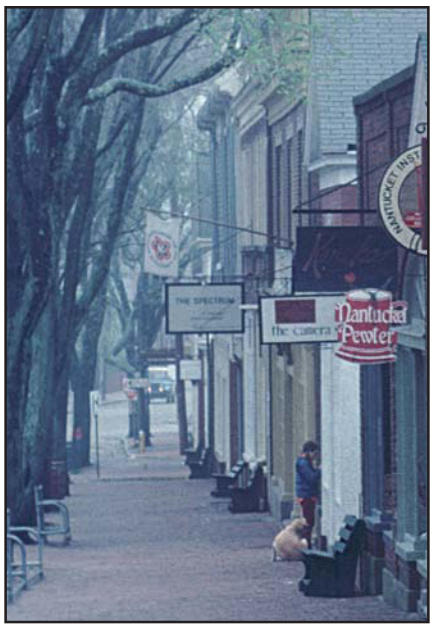
A polarizing filter (top) darkens the sky and removes reflections from foliage so it has more color. A shot without a filer is shown at the bottom.

Cases protect lens from shocks and other abuse.

HOW A PHOTOGRAPH SHOWS DEPTH

A photograph can appear to compress space so that objects look closer together than you expect. Another photograph of the same scene can seem to expand space so that objects appear farther apart than normal. These apparent changes in perspective—the appearance of depth in a photograph—are often attributed to the focal length of the lens being used but are actually caused by the distance of the lens from the subject.

The image on the left appears to be more "open" and spacious than the more visually "compressed" one on the right. However, the image on the right is actually contained in the image on the left. It just appears more compressed because the enlarged section includes only those elements farthest from the camera.



Changing camera-to-subject distance does change perspective as shown here. As the camera moves closer to the foreground subject (right), the background appears to increase in size relative to the foreground. This changing relationship between the size of objects in the foreground and background creates the difference in perspective.

Chapter 6
Using Automatic Flash

CONTENTS

■ How Flash Works ■ Using Autoflash ■ Portraits With Flash ■ Using Fill Flash ■ Using Slow Sync Flash ■ Using Available Light ■ Controlling Flash Exposures ■ Using an External Flash

Automatic electronic flash is so convenient and easy to use that you are sometimes unaware it even fires. With your camera on automatic, it's always ready when your autoexposure system decides it's needed. But this on-camera flash lighting has certain characteristics that can make a difference in the way your pictures look. For example, the pictures will have a "flat" lighting typical of on-camera flash. Alternative approaches, such as using an external flash or even just turning the flash off may produce more interesting results. In any event, you will be able to use flash to better advantage as you become more familiar with its characteristics. In this chapter we introduce some of the Canon flash terms you need to be familiar with, followed by sections on flash techniques, and ending with descriptions of the features offered on optional Canon EX-series flash units.

HOW FLASH WORKS

The built-in flash pops-up on top of the camera.

The Digital Rebel has a built in pop-up flash and a hot shoe into which you can slip any Canon EX-series flash when you want more power or features. Both options give you access to Canon's advanced flash technology.

Every flash has a maximum useful range. How bright the light from a flash is when it reaches a subject depends on the flash's power and on how far the light has to travel. The further the subject is from the flash, the less light will reach it and so the less light will be reflected from the subject back toward the camera.

Flash light falls off (becomes dimmer) the farther it travels. Objects near the flash will be lighter in a picture than objects farther away. You can use this to advantage; for example, at night you can isolate a subject against a dark background.

When the flash fires, the beam of light expands as it moves father from the camera so it becomes weaker the farther it travels. The rate at which the light falls off is described by the *inverse square law*. If the distance between the flash and subject is doubled, only one quarter the amount of light will reach the subject because the same amount of light is spread over four times the area. Conversely, when the distance is halved, four times as much light falls on a given area.

When subjects in an image are located at different distances from the camera, the flash exposure will only be correct for those at one distance—normally those closest to the camera or in the middle of the area metered by the autoexposure system. Subjects located farther from the flash will be increasingly darker the farther they are from the flash.

AUTOZOOM

Autozoom flashheads automatically zoom the flash as you zoom the lens. As you zoom in on a subject, the flash beam narrows, and when you zoom out, it widens. The result is that you have flash coverage of the image area at all times.

USING AUTOFLASH

TIP

The built-in flash has a guide number of 43/13 (ft/m) at ISO 100.

The Digital Rebel's built-in flash lets you get better photos in dim light or backlit situations. It has the following coverage and range:

■ The flash can cover the same area as an 18mm lens (28mm equivalent on a 35mm camera). Some lenses and lens hoods may block part of the flash and cast a shadow on the scene. If this happens use an external flash.

■ The range of the flash varies with the ISO (page 48) and the focal length of the lens or the amount of zoom. Here are some examples using the EF-S 18-55mm lens designed specifically for the Digital Rebel. In all cases the minimum distance at which flash can be used without overexposing the main subject is 2.3 feet (0.7m). Only the maximum distances vary as follows:

ISO	18MM LENS	55MM LENS
100	12.1′ (3.7m)	7.5′ (2.3m)
200	17.4′ (5.3m)	10.8′ (3.3m)
400	24.3′ (7.4m)	15.1′ (4.6m)
800	34.5′ (10.5m)	21.6′ (6.6m)
1600	48.9′ (14.9m)	30.2′ (9.2m)

In all modes flash metering it is linked to the active AF point (page 55). If the camera has trouble focusing, the flash pops up in Basic Zone modes other than Landscape, Sports, and Flash Off. In those modes and others where you have manually popped it up, it strobes to assist focusing (page 53). Other features depend on weather you are in the Basic or Creative Zone.

The flash button that pops-up the flash in Creative Zone modes.

FLASH IN THE BASIC ZONE

When the Mode Dial is set to any mode in the Basic Zone other than Sports, Landscape, or Flash Off the flash pops up automatically and fires when the light is dim, or the subject is backlit. You can't pop it up yourself in this zone, and you can't prevent it from firing if it wants to. When taking pictures in areas where flash isn't permitted or wanted, you can prevent the flash from firing by switching to Flash Off mode or selecting any mode in the Creative Zone.

The flash icon.

FLASH IN THE CREATIVE ZONE

When the Mode Dial is set to any mode in the Creative Zone (P, Tv, Av, M, or A-DEP), you have to pop up the flash by pressing the Flash button marked with a lightening bolt icon on the left side of the lens mount.

■ In A-DEP and P (Program AE) modes the flash is fully automatic. The shutter speed is automatically set to between 1/200 and 1/60 and the aperture is set by the E-TTL program (page 100).

■ In Tv (shutter-priority) mode, you select a shutter speed of 1/200 second or slower, and the camera selects the aperture. The exposure of the main subject is determined by the flash and the exposure of the background is determined by the shutter speed.

TIP

In Tv and M modes, if you select a shutter speed faster than 1/200, it is automatically reset to 1/200 unless you are using an external flash set to high speed sync (page 102).

- In Av (aperture-priority) you set the aperture and the shutter speed is automatically set to 1/200 seconds or slower. In Av mode, when you photograph a subject against a dark background such as the night sky, the camera automatically uses slow-sync (page 98) mode. In this mode the flash illuminates the subject and the shutter speed is slowed down to lighten the background. Because the slower shutter speed can create image blur due to camera or subject movement, use a camera support and photograph a static subject or use the blur creatively.
- In M (manual) mode, you set the shutter speed to 1/200 or slower, and select a matching aperture. The exposure of the main subject is determined by the flash and the exposure of the background is determined by the aperture and shutter speed settings.
- Although the built-in flash cannot work with a shutter speed faster than 1/200 second (the sync speed), some external flash units such as the Canon 550EX let you use high-speed sync with faster shutter speeds (page 102).

The flash icon.

QuickSteps USING AUTO FLASH

1. With the camera on do one of the following:
   - In Basic Zone modes, set the camera to any mode other than Landscape, Sports, or Flash Off where the flash won't fire.
   - In Creative Zone modes, press the Flash button (a lightening bolt icon) on the left side of the lens mount to pop up the flash.
2. Press the shutter button halfway down. (In Basic Zone modes the flash will pop-up if needed.) When the flash icon lights up in the viewfinder, the flash is ready to fire.
3. Press the shutter button all the way down to take the picture.
4. When finished with the flash, press it down to close it.

Slow sync flash (page 98) lets you get interesting effects.

The flash button that pops-up the flash in Creative Zone modes.

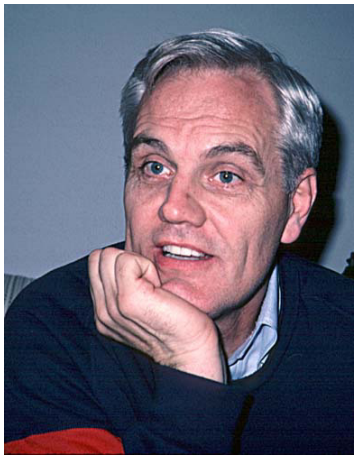
Portraits with Flash

Flash is a good source of light when you want to make portraits, particularly of children. The light from the flash is so fast that you never have to worry about your subject moving during the exposure and blurring the picture. For the same reason you don't have to be quite as careful about camera motion blurring the image; you can hand-hold the camera and shoot as rapidly as the flash will recharge.

POSITIONING THE FLASH AND SUBJECTS

You may want to choose carefully the position of the flash. Light from a flash built-into the camera often produces less attractive results than if you use an external flash to bounce the light onto the subject off a wall, ceiling, or umbrella reflector.

When photographing more than one subject, each is given the same importance when lined up parallel to the camera because each receives the same amount of flash illumination. If subjects are at different distances from the flash, they will be illuminated differently. This is a good way to make one more visually dominant than others in the image.



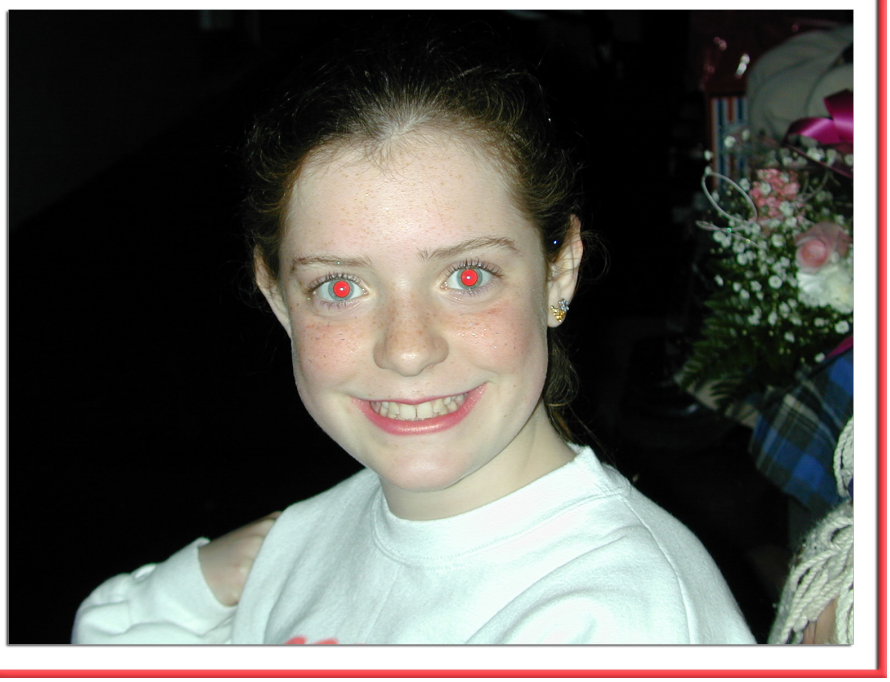
When a subject is placed close to a wall, there will almost always be a distracting shadow in the image cast by the light from the flash. By moving the subject away from a wall, these shadows disappear.

RED-EYE

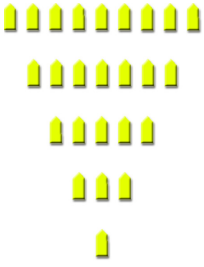
When photographing people, you'll often see images with what's called "red eye." The light from a flash has entered through the subject's pupil, reflected off the back of the eye (the retina), and bounced back out to the camera. Since the retina is full of thin blood vessels, the eyes take on a red color. To reduce red-eye when using the built-in flash, the Digital Rebel has a red-eye reduction mode that lights a red-eye reduction lamp to close the subject's iris when you press the shutter button halfway down.

The best way to eliminate red-eye is to use an external flash (page 99) because it's positioned farther away from the axis of the camera lens and you can also use it to bounce flash off a wall or ceiling. If you have to use the built-in flash, turn on red-eye reduction, tell the subject to look directly at the camera, get close, increase the overall room lighting, or have the subject look for a few moments at a bright window. You can remove red-eye using software, but it's a lot easier to avoid it to begin with.

In black & white, red-eye can look eerie. In color it's even more so.



There is no way to illustrate red-eye in a book that's printed in black and white. However, for your entertainment, Eric shows one way it can be avoided.



The red-eye countdown timer in the viewfinder flashes fewer and fewer indicators as it gets closer to finishing. When the last indicator goes out, take the picture.

With red-eye turned on, when you press the shutter button halfway down and the camera focuses, the red-eye reduction lamp lights and its countdown timer appears in the viewfinder. You can shoot anytime the indicator is displayed, but for the greatest effect press the shutter button all the way down to take the picture just after this indicator goes out.

QuickSteps TURNING RED-EYE MODE ON AND OFF

1. With the Mode Dial set to any mode, press MENU and select the shooting menu tab.
2. Highlight *Red-eye On/Off* and press SET to display choices.
3. Highlight *On* or *Off* and press SET to select it.
4. Press the MENU or shutter button to hide the menu.

USING FILL FLASH

When photographing people or other subjects in bright sun, shadow areas can be so dark in the image that they show little or no detail. If the shadow cover a large part of the subject, the effect can be distracting and unattractive. You can lighten such shadows by using flash to "fill" the shadows to lighten them. With the Digital Rebel, you do so by popping up the flash so it fires even when there is enough available light to take the picture. It should pop-up and fire automatically in some Basic Zone modes, but to be sure, switch to a Creative Zone mode and press the flash button to pop it up.

With no fill flash (above) the bright background has caused the main subject to be underexposed. Using fill flash (right) correctly exposes the main subject.

The flash button that pops-up the flash in Creative Zone modes.

QuickSteps USING FILL FLASH

- With the Mode Dial set to any mode in the Creative Zone, press the Flash button marked with a lightening bolt icon on the left side of the lens mount to pop up the flash.
- With the Mode Dial set to any mode in the Basic Zone other than Landscape, Sports, and Flash Off, the camera will recognize a backlit situation and pop up and fire the flash automatically.

TIP

- Using fill flash is a good way to get accurate color balance under unusual lighting.

USING SLOW SYNC FLASH

A slow shutter speed and flash combined to create these photos showing both sharpness and blur.

Normally, when you photograph a subject in dim light, the flash properly exposes the foreground subject but the background is dark or black. One technique you can use to lighten the background is called *slow sync flash*. You let the flash fire as normal but select a slow shutter speed to lighten the background. This works best when the main subject is fairly close to the camera and the background isn't totally black—even better if it has some light on it as a cityscape does.

Because the flash freezes the nearby subject, and the slow shutter speed then lets both it and the background blur if there is any camera of subject movement, you can get some interesting and creative effects. (Using a camera support will eliminate blur due to camera motion.) For example, if the scene you are photographing contains bright lights, such as automobile head or tail lights, you'll get streaks in your image if either the camera or subject moves. In Av mode, when you photograph a subject against a dark background such as the night sky, the camera automatically uses slow-sync mode. In this mode the flash illuminates the subject and the shutter speed is slowed down to lighten the background.

At a shutter speed of 1/200, or when the foreground subject is too far from the camera, the effects of slow sync aren't always apparent. However, at slower shutter speeds and with closer foreground subjects, the effects get more pronounced.

A slow shutter speed and flash combined to create this photo showing both sharpness and blur.

TIPS

- Night Portrait mode (page 24) uses slow sync flash and is a good way to start exploring how it affects your images.
- When using slow sync flash, long exposure times may create unwanted blur in the image. At times like this, you may want to use a camera support (page 47).

QuickSteps USING SLOW SYNC FLASH

- To use first curtain sync automatically, set the Mode Dial to Av (aperture-priority).
- To better control slow sync effects, set the mode dial to shutter-priority (Tv) mode and control the amount of blur by varying the shutter speed. Try 1/20 or so to start.

USING AVAILABLE LIGHT

There are times when the light is dim but you want to capture the unique colors of the available light, or you want to photograph in places where flash isn't allowed. In these circumstances you need to prevent the built-in flash from firing and support the camera for a long exposure. If the flash fires, foreground subjects will appear as if photographed in daylight. If you don't support the camera you will likely have blur from camera movement.

Available light can add beautiful colors to a photograph.

The lens was zoomed during a long exposure.

TIP

When the Mode Dial is set to any mode in the Basic Zone, other than Sports, Landscape, or Flash Off you can't prevent the flash from firing in dim light.

QuickSteps PREVENTING THE FLASH FROM FIRING

- In the Basic Zone, set the Mode Dial to Sports, Landscape, or Flash Off.
- In the Creative Zone, close the built-in flash if it's popped up.

When photographing in dim light there are things you can do to get better results without using the flash. Try the following procedures described on pages 47–48:

- Increase the camera's ISO although it will add noise to the image.
- Use the camera's self-timer or remote control to trigger the shutter so you don't introduce camera motion when pressing it with your finger.
- Support the camera or use a tripod and a remote control.

CONTROLLING FLASH EXPOSURES

When photographing people or other subjects, there are times when the main subject is too dark or light. In these situations, you can adjust the flash power to lighten or darken the flash illuminated part of the image. This is like exposure compensation for flash. As you've seen, you can use exposure compensation, exposure lock and autoexposure bracketing to control daylight exposures (pages 41–42). You can have the same control when using flash.

WHAT'S E-TTL?

The Digital Rebel features an E-TTL (evaluative; through the lens) flash system that gives outstanding natural-looking flash pictures. When used for fill flash outdoors E-TTL balances the light so well that it isn't even obvious that flash was used.

E-TTL flash works by firing a preflash in the brief instant after you press the shutter button and before the camera's reflex mirror goes up. The preflash is used to set focus and exposure. The exposure of the main subject to be illuminated by the flash is determined by evaluative metering tied to the active focus points. Flash metering is initially based on all focusing points with special emphasis given to the one that's active. However, if an object with an unusually strong reflection, such as a mirror or window, is detected in any of the other metering zones the reading from that zone is factored out to prevent incorrect exposure.

The camera also uses evaluative metering (page 33) to calculate the background exposure. It combines the two readings to calculate and store the flash output required for optimum exposure of the main subject, while maintaining a subtle balance between flash and natural lighting. The flash setting determines the exposure of the main subject on the active focus points and the aperture and shutter speed determine the exposure of the background.

FLASH EXPOSURE COMPENSATION

Flash exposure compensation lets you manually adjust the amount of flash illuminating the subject without changing the camera's aperture or shutter speed. Although not available on the Digital Rebel, it is on Canon's external flash units. This is an ideal way to balance flash and natural light when using fill flash and to correctly expose scenes or subjects that are darker or lighter than normal (middle-gray). You can vary flash exposures plus or minus 2 stops in one-half stop increments for any attached EX-series Speedlite.

You can use flash exposure compensation in conjunction with regular exposure compensation. Doing so lets you use regular exposure compensation to lighten or darken the background that's illuminated by natural light, and use flash exposure compensation to lighten or darken the subject illuminated by the flash. This is a powerful combination of exposure controls that let's you capture images just the way you want them.

When flash exposure compensation is being used, the flash exposure compensation icon lights up in the viewfinder.

The left flower was taken with a normal flash exposure. The one on the right was taken after exposure compensation was set to -2.

FLASH EXPOSURE LOCK (FEL)

Flash exposure lock (FE Lock) acts much like the more familiar AE Lock (page 41). When you use this feature, a preflash is fired and the exposure system reads the flash exposure at the active focus point. The captured reading is stored for about 16 seconds so you have time to recompose the scene or make exposure or focus adjustments without losing your flash exposure information. (If you don't do anything for 16 seconds, FE Lock is cancelled.) FE lock is extremely useful when you wish to place the main subject in a part of the picture area that is not covered by one of the focusing points. It can also eliminate potential exposure errors caused by unwanted reflections from highly reflective surfaces such as windows or mirrors.

The AE/FE Lock icon.

QuickSteps USING FLASH EXPOSURE LOCK

1. Set the Mode Dial to any mode in the Creative Zone and press the Flash button (a lightening bolt icon) to pop up the flash.
2. Press the shutter button halfway down to focus on the subject that you want to lock flash exposure on, and press the AE/FE Lock button. A preflash fires, *FEL* is displayed briefly in the viewfinder, and the AE/FE Lock icon is displayed in the viewfinder to indicate flash exposure is locked. (If the flash icon in the viewfinder blinks, move closer and repeat this step or the image will be underexposed.
3. Recompose the scene and take the picture. To cancel FE Lock, release the shutter button and wait for the * icon to disappear. To keep it locked, continue to hold the shutter button halfway down.

USING AN EXTERNAL FLASH

The 550EX flash.

The small automatic flash built into your camera is convenient, however its range is short and it is so close to the lens that photos of people often capture them with red eyes. It also emits a hard, direct light and can't be rotated to bounce flash off a wall or ceiling to soften it.

For better flash photography you need a hot-shoe mounted Canon EX-series Speedlite such as the 550EX, 420EX, 220EX, MR-14EX, MT-24EX, or ST-E2. Any of these can be mounted on the cameras hot shoe or attached by a sync cord for off-camera use. When using these flash units, the camera controls the exposure just as it does with the built-in flash. (You can't use both the built-in and external flash at the same time so close the built-in flash when you attach the external one.) One of the biggest advantages of these units is that they let you swivel or rotate the flash head so you can bounce light off walls and ceilings. This lets you get softer light on the subject so contrast is reduced and hard shadows are minimized. Let's take a look at some of the features you'll have access to on EX flash units. All of these features are available with the 550EX, but not all are available on other units.

TIPS

- The built-in flash doesn't support FP high-speed sync operation flash. To use this feature you need a compatible EX flash such as the 420EX or 550EX.
- When using an external Speedlight, it may emit an AF-assist beam so the camera can focus in the dark. The camera may not be able to focus if you have selected an off-center focus point (page 55).

HIGH-SPEED SYNC (FP)

The shutter speed you use when shooting with flash is important. When you take a flash photo, the first shutter curtain opens to begin the exposure, then the second curtain closes to end it. At shutter speeds above 1/200 the second curtain starts to close before the first curtain is fully open. As a result, a "slit" formed by the two curtains moves across the image sensor and normally only a part of the image can be captured by the brief burst of flash. The rest of the sensor is blocked by one or both curtains.

To get a fully exposed image at fast shutter speeds, the flash must fire when the shutter is fully open. This timing between the flash and the shutter is called *flash synchronization* or *X sync*. On the Digital Rebel, the shutter is fully open only at shutter speeds of 1/200 second and slower. Faster shutter speeds require what's known as high-speed sync flash (also called FP or focal plane sync). High-speed sync can capture a fully exposed image because the flash fires repeatedly as the "slit" moves across the image sensor during the exposure. The only drawback is that the flash power is reduced so you can't be positioned as far from a subject. The higher the shutter speed you use, the closer you have to be.

Since this feature lets you use flash at shutters speeds as fast as 1/4000 second, Canon lists three situations where you might find it useful:

- When using fill flash out of doors, you can use a fast shutter speed to freeze action, or a wide aperture to throw the foreground or background out of focus.
- When doing a portrait and want catchlights in the subject's eyes.
- When using fill flash to lighten shadows.

The flash exposure bracketing icon.

FLASH EXPOSURE BRACKETING (FEB)

Flash exposure bracketing (FEB) takes a series of three consecutive pictures exposed at slightly different settings up to three stops above or below the exposure recommended by the autoexposure system in half-stop increments. The flash output changes with each image while the background exposure level remains the same.

The 550EX Speedlite was developed specifically for Canon's EOS cameras and takes full advantage of those camera's autofocus (AF) technology and E-TTL autoflash. The flash has a maximum Guide Number of 180 (ISO 100, ft.), an AF-assist beam which links to the Digital Rebel's 35-point area AF, FP Flash (high speed sync), FE lock (a flash version of AE lock), and FEB (Flash Exposure Bracketing).

WIRELESS REMOTE FLASH

Wireless flash lets you mount a master flash such as the 550EX, or a transmitter (ST-E2) on the camera's hot shoe and fire off an unlimited number of other remote flash units (550EX or 420EX units). This allows you to get lighting effects you couldn't possibly get with a single unit. The on-camera flash or transmitter (the master unit) transmits wireless signals to the units (the slaves) telling them when to fire. The master flash on the camera can be enabled or disabled. When disabled, it still transmits signals to the remote units.

You can set up as many as three groups (designated A, B or C) of slaves with a virtually unlimited numbers of flash units within each group. This allows you to independently control main, fill, and back lighting. Even when using multiple Speedlites, you can use all of the 550EX's advanced features including E-TTL, FP high-speed sync flash, flash exposure lock and flash exposure bracketing.

The output ratio of two different slave groups can be set on the master unit eliminating the need to adjust each slave unit individually. The A:B flash ratio can be set to any of thirteen half-stop increments ranging from 8:1 to 1:8. Flash exposure compensation for slave group C can be set on the master unit in 1/3 or 1/2 stop increments up to +/- 3 stops. This is ideal for background or accent lighting when shooting portraits in a studio setting. The wireless remote flash system has a range of approximately 35 feet when used outdoors and approximately 50 feet indoors. Each slave unit, when signaled by a test flash from the master unit, indicates its readiness in ascending order according to its assigned group so you know that the slave units are within range and functioning properly. An LED indicator on the back of the master unit acts as a flash exposure confirmation signal, and is fully effective even in wireless multiple flash setups. When using wireless remote flash, you can use a modeling light that illuminates the subject for a full second so you can preview flash effects such as shadows and light balance before taking a picture. If you are using one or more slave units, the modeling light uses the flash ratios you have chosen.

STROBOSCOPIC FLASH

Stroboscopic flash fires the flash a number of times at high speed to capture multiple images of the same subject in the same photograph. You've probably seen examples of this mode in sports photography where it can be used to demonstrate or analyze a swing of a bat or club.

PC TERMINAL

The Digital Rebel doesn't have a PC (Prontor-Compur) terminal that lets you can use cables to connect the camera to a studio flash. However, you can buy a hot shoe adapter for this purpose from many third-parties.

Chapter 7
Exploring Close-up Photography

CONTENTS

■ Macro Lenses and Accessories ■ Focusing and Depth of Field ■ Exposures and Backgrounds ■ Arranging Lighting ■ Using Flash in Close-ups

One thing digital cameras are great for is photographing small objects—coins, jewelry, prints, maps, flowers, even insects—anything small enough to fit on a tabletop. You can put photos of your collectibles onto a Web page, sell them on an on-line auction, or make prints to file in a safe deposit box for insurance purposes.

In close-up or tabletop photography, digital cameras have a huge advantage over traditional film cameras because you can review your results and make adjustments as you shoot. If a photo doesn't turn out as you'd hoped, just delete it and try something new. A film photographer has to wait to get the film back from the lab before they can make adjustments. By then, they have probably taken apart the tabletop setup or forgotten what it was they did. Take advantage of your instant feedback to experiment and learn.

The guidelines that follow are just that—guidelines. Feel free to experiment and break the rules. Never let the fact that you don't have something such as a light source stop you. Innovate and experiment. That's how great photographs are taken.

Macro Lenses and Accessories

When photographing small objects from coins to insects, your lens' focal length and minimum focusing distance affect how small objects are captured in photos. For example, if you're photographing a small coin, you probably don't want it to appear as a tiny coin surrounded by a large background. More likely you'd like a photo showing a large coin surrounded by a small background. For many pictures, just zooming your lens in on the subject will suffice. However, macro lenses allows you to get a lot closer to the subject, making it much larger in the final image. If you can't get close enough to an object to fill the image area, you can always crop out the unwanted areas later. However, the more you crop, the smaller the image will become.

This small, but very colorful caterpillar was captured with a macro lens.

For close-up photography there is no substitute for a tripod with a center column that can be swung off-center to get closer to the ground, and a ball head to make positioning the camera fast and easy.

Canon offers a wide range of macro lenses that are compatible with EF Extension Tubes EF12II and EF25II and Macro Ring Lites ML-3 and MR-14EX.

■ Extension fit between the lens and the camera body and allow the lens to focus much closer than normal, giving increased magnification. The larger the amount of extension and the shorter the focal length of the lens used, the greater the increase in magnification. Because of the Digital Rebel's new lens mount, new extension tubes EF12II and EF25II replace the Extension Tubes EF12 and EF25. These are the only extension tubes that work with the EF-S 18-55mm but they also work with almost every available Canon EF lens. Magnification varies, but for standard zoom lenses it is about 0.3 to 0.5 for the Extension Tube EF12II and 0.7 or over for the Extension Tube EF25II.

■ The EF 50mm f/2.5 Compact Macro focuses up to 9.1 inches (231mm) for 1:2 (half life-size) magnification. At 9.1 inches and f/11 depth of field is 0.24 inches (6mm). The EF Life Size Converter for the lens extends its range to between 1:4 and 1:1 magnification and also compensates for spherical aberrations.

■ The EF 100mm f/2.8 Macro USM lens focuses over the full range from infinity down to life size (1:1 reproduction ratio). The lens allows full-time

TIP

The close-up mode in the Basic Zone can be used with any lens to get close-ups at the lenses' minimum focusing distance. It's no substitute for a macro lens.

The Canon Life-size Converter EF is an extension tube.

manual focusing so you can override autofocus whenever you want. When shooting at life size (1x) magnification, the minimum working distance between the lens and the subject is approximately 6 inches (152mm), providing enough room for an additional light source.

■ The EF 180mm f/3.5L MACRO USM Telephoto Lens shoots throughout the focusing distance range from 1x to infinity. The lens has full-time mechanical manual focusing and focuses as close as 1.5ft (0.48m).

■ The manual focus MP-E65mm f/2.8 Macro Photo Lens extends the capabilities of conventional macro lenses and is designed exclusively for high-magnification close-ups from 1x to 5x. Working distances (from the front of the lens to the subject) range from 4 inches at 1x (life size) to 1.6 inches at 5x. The lens is equipped with a detachable tripod collar.

Angle Finder C.

■ Canon's Angle Finder C attaches to the viewfinder eyepiece so you can photograph from a low angle without kneeling or lying down. It's also great when doing copy work and macro photography. It features a rubber eyecup, a built-in adjustable diopter, and a roof prism that keeps the image correctly oriented. The viewfinder has switchable magnification (1.25x or 2.5x). The 1.25x setting shows the entire frame including exposure data outside the picture area, while the 2.5x setting provides a magnified view of the center of the image area—excellent for critical focusing with macro lenses and other specialty optics.

A monarch butterfly captured with a macro lens.

This Canon MP-E65mm f/2.8 1-5x Macro lens is a 5x lens on a 35mm camera.

Focusing and Depth of Field

TIP

You can use manual focus (page 56) to set a focus distance and then move the camera in and out to bring the subject into focus.

If you look at some close-up photographs, you will notice that very few of them appear to be completely sharp from foreground to background; in other words, the depth of field in a close-up tends to be shallow. The depth of field in an image depends on how small an aperture you use, how close you are to a subject, and the focal length of the lens. When you get the camera really close, don't expect much depth of field—maybe as little as a quarter-inch. To keep things in focus, it's best to arrange subjects so they all fall on the same plane. That way, if one's in focus, they all will be. Another thing to try is a shorter focal length lens with a wider angle of view. This will give you more depth of field if you don't also have to move the camera closer to the subject (doing so will offset the advantage of the wide-angle lens). To increase depth of field, switch to Av (aperture-priority) mode and select a small aperture such as f/11 (page 29).

Also, when you focus, keep in mind that depth of field includes the plane you focus on plus an area in front of and behind that plane. You'll find that in close-ups half of the sharpest area will fall in front of the plane on which you focus and half behind it.

Shallow depth of field has its own benefits, so you don't necessarily have to think of it as a problem. An out-of-focus foreground or background can help isolate a small subject, making it stand out sharply.

In the upper-left photo, a small aperture has given great depth of field. In the lower-right photo, a large aperture has given a shallow depth of field. In both images, the camera was focused on the same face.

TIP

To check depth-of-field in the viewfinder when using Creative Zone modes, press the depth-of-field preview button (page 57).

QuickSteps INCREASING DEPTH OF FIELD IN CLOSE-UPS

- Increase the illumination of the subject to stop down the aperture.
- Don't get any closer to the subject than you have to.
- Focus on the middle of the scene (front to back) since in close-ups, depth of field is half in front and half behind the plane of critical focus.
- Use aperture-priority or A-DEP modes (pages 29, 58)

Exposures and Backgrounds

The exposure procedure for close-up and tabletop photography isn't a lot different from normal photography, but you have the opportunity to control lighting. The biggest difficulty may arise from automatic exposure. Many close-up photographs are of small objects that don't entirely fill the viewfinder frame. Automatic exposure systems can be fooled if the brightness of the small object is different from the brightness of the larger background. The meter averages all of the light reflecting from the scene and may select an exposure that makes the main subject too light or too dark. In these cases, use exposure compensation to adjust for the background. If an image is too dark, increase the exposure. If the image is too light, decrease the exposure.

Some thought should be given to the background you use. It should be one that makes your subject jump out, and not overwhelm it. The safest background to use is a sheet of neutral gray poster board that can be formed into a curved "L" shape to give a nice smooth gradation of light behind the image. It's safe, because it reduces potential exposure problems and most things show well against it. Other options include black or white backgrounds but they may cause some exposure problems unless you use exposure compensation. Finally there are colored backgrounds, but these should be selected to support and not clash with the colors in the subject.

The texture of the background is also a consideration. For example, black velvet has no reflections at all while black poster board might show them.

A white background (left) causes the clock to be underexposed and too dark while a gray background (right) gets the exposure correct.

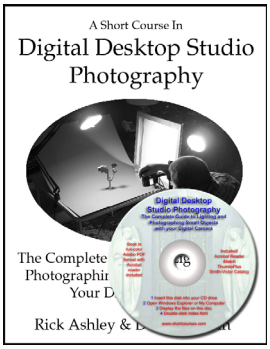
A dark background sets off an insect.

ARRANGING LIGHTING

When photographing flat copy, you need even lighting.

The lighting on small objects is just as important as it is for normal subjects. Objects need to be illuminated properly to bring out details and colors. You can light a subject in several ways, depending on your objectives. A flat object needs to be illuminated evenly; an object with low relief, such as a coin needs to be cross-lit to bring out details; some objects might look better with the diffuse lighting provided by a light tent (see below). Electronic flash can freeze action and increase depth of field. Your options are varied, limited only by your willingness to experiment.

Flat copy such as posters, stamps, prints, or pages from books require soft, even light over their surface and the camera's image sensor must be exactly parallel to it to prevent "keystoning." Even then, most lenses will curve otherwise straight lines at the periphery of the image because they are not designed for copying and are not perfectly rectilinear. (This is called curvilinear distortion.) There are other lens aberrations that make it difficult to keep the entire image in focus at the same time. One suggestion is to use a small aperture that increases depth of field and uses the center portion of the lens where aberrations are least likely to affect the image.



We've written a book/eBook on everything you'd want to know about lighting smaller objects. You can learn more at the ShortCourses.com bookstore.
http://www.shortcourses.com

Keep in mind that the color of the light you use to illuminate an object may affect the colors in the final image. Tungsten bulbs will give it an orange cast and fluorescent lights will give it a green cast. You'll have to experiment with this aspect using white balance settings (page 65). In other cases, you may find that you like the artificial colors or you may be able to adjust them in your photo-editing program.

USING A REFLECTOR TO LIGHTEN SHADOWS

When the light illuminating a small subject casts hard, dark shadows, you can lighten the shadows by arranging reflectors around the subject to bounce part of the light back onto the shadowed area. You can use almost any relatively large, flat reflective object, including cardboard, cloth, or aluminum foil (crumpling the foil to wrinkle it, then opening it out again works best). Position the reflector so that it points toward the shadowed side of the subject. As you adjust the angle of the reflector, you will be able to observe its effects on the shadows. Use a white or neutral-toned reflector so the color of the reflector doesn't add a color cast to the image.

USING A LIGHT TENT

A light tent can make an amazing difference in table-top photos. http://www.ezcube.com/

One way to bathe a subject in soft, even lighting—particularly useful for highly reflective subjects such as jewelry—is by using a simple light tent. The object is surrounded by a translucent material which is lit from the outside. If the subject is small enough, you can use a plastic gallon milk bottle with the bottom cut out and the top enlarged for the camera lens. When positioned over the subject and illuminated by a pair of floodlights, the light inside the bottle is diffused by the translucent sides of the bottle. The result is a very even lighting of the subject.

Larger subjects require larger light tents. You can construct a wooden frame and cover it with cloth or plastic sheets. When illuminated from outside by two or more floodlights, the light within the tent will be diffuse and nondirectional.

USING FLASH IN CLOSE-UPS

FLASH IN CLOSE-UPS

When using the built-in flash for macro close-up images, the flash may not fully illuminate the subject because of its position. Be sure to take a test shot.

There are two important reasons to use flash in tabletop photography. With flash, you can use smaller apertures for greater depth of field, and extremely short bursts of light at close distances prevent camera or subject movement from causing blur. Using electronic flash with predictable results takes a little effort and you may need to practice and experiment.

Direct on-camera flash doesn't give a picture the feeling of texture and depth that you can get from side-lighting. If you use an external flash (page 99), you can bounce the flash to illuminate the subject from an angle for a better lighting effect.

A special kind of flash is the ring flash. These units fit around the lens and fire a circle of light on the subject. They are ideal for shadowless close-up photography such as that used in medical, dental, and nature photography. Because ring flash is so flat (shadowless), they allow you to fire just one side of the ring or the other so the flash casts shadows that show surface modeling in the subject.

The Macro Ring Lite MR-14EX

Canon's Macro Ring Lite MR-14EX provides you with full E-TTL flash capability when used with the Digital Rebel. With a Guide Number of 46 (ISO 100/ft.), the MR-14EX mounts directly to Canon EF Macro lenses. It offers flash exposure lock, FP high-speed sync, an a number of other features. The flash has two flash tubes that can be used together or independently. When both flashes are fired in E-TTL and used together, lighting ratios can be set in one-half stop increments up to +/- 3 stops. Lighting ratios can also be controlled between the left and right tubes, even when the flash is placed in its manual mode, and you can select variable power settings over a 7-stop range down to 1/64th power.

The Macro Ring Lite is also equipped with twin focusing lamps and a set of 7 Custom Functions that allow you to modify flash operation for specific shooting conditions. The MR-14EX requires 4 AA-size batteries and is equipped with a socket for optional external power supplies such as the Canon Compact Battery Pack CP-E2 to reduce recycling time and increase the number of flashes per set of batteries.

Flash was used to freeze this small green stinkbug.

The Macro Twin Lite, designed for serious close-up, nature, and macro photography, gives a directional quality of light, rather than the flat light character of the ring flash. Two separate flash heads can be swiveled around the lens, can be aimed separately, and even removed from their holder and mounted off-camera. Like the MR-14EX, the new Macro Twin Lite MT-24EX is fully E-TTL compatible with all EOS bodies, including digital SLRs, and even allows Wireless E-TTL flash control with one or more 550EX and/or 420EX "slave units." It also provides easy ratio control of each flash head's output, over a six-stop range.

The Macro Twin Lite MT-24EX has two separate flash heads that can be swiveled around the lens and aimed separately.

Chapter 8
Other Features and Commands

CONTENTS

■ Continuous Photography ■ Using the Set-up Menus ■ Entering a Print Order ■ Selecting and Creating Parameters ■ Caring for Your Camera

The Digital Rebel has many settings that control how your camera operates or performs other useful functions. In this chapter we discuss those features not covered elsewhere in the book. You'll see how to shoot in continuous mode, use the Set-up menus, set review times, enter a print order right on the CF card, care for your camera, and make many other useful settings. You should find a great deal of useful information here that you'll be glad to know.

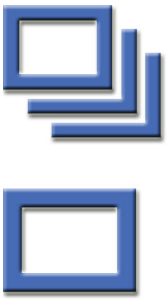
CONTINUOUS PHOTOGRAPHY

The DRIVE button icon.

To be sure you've captured a fleeting moment, you can use continuous mode to capture up to 4 images at 2.5 images per second in all image modes including RAW. You can then choose the best image from the sequence or use all of them to create an animation on your computer. One way to do this is to create an animated GIF. When viewed with a Web browser, the images are quickly displayed one after the other like frames in a movie. One shareware program you can use is GIF Construction Set at http://www.mindworkshop.com.

Images are first stored in a buffer, basically internal memory, because this can be done faster than storing them to a CF card. When the buffer becomes full, the camera displays *buSY* as it moves images from the buffer to the CF card. After an image is moved and room is again available in the buffer, the camera will capture another image. There is a readout to the left of the viewfinder's focus indicator that always indicates how many more images will fit in the buffer

- Continuous is the only mode available in Portrait and Sports modes.
- Single-frame is the only mode available in Full Auto, Landscape, Close-up, Night Portrait, and Flash Off modes.
- Either single-frame or continuous mode is available in all Creative Zone modes.
- Continuous mode will work with flash but pictures are taken more slowly because the camera has to wait for the flash to recycle.



The continuous (top) and single-frame (bottom) icons.

QuickSteps TURNING CONTINUOUS MODE ON AND OFF

1. With the Mode Dial set to any mode in the Creative Zone, press the DRIVE button repeatedly until the continuous mode icon is displayed on the LCD panel. (Continuous mode is selected automatically in Portrait and Sports modes in the Basic Zone.)
2. To run off photos, hold down the shutter button until you or the camera decides enough is enough. As you take pictures, the image countdown is displayed at the bottom of the viewfinder next to the focus confirmation indicator. When the buffer is full, *buSY* is displayed in the viewfinder and on the LCD panel. You can't take any more pictures until it goes away.
3. When finished repeat Step 1 but select a different mode or display the single-frame icon on the LCD panel.

Continuous mode can capture a series of positions in sports photography.

USING THE SET-UP MENUS

SET-UP 1 COMMANDS (ORANGE)
- Auto power off
- Auto rotate
- LCD Brightness
- Date/Time
- File numbering
- Format

SET-UP 2 COMMANDS (ORANGE)
- Language
- Video system
- Communication
- Clear all camera settings
- Sensor clean
- Firmware Ver

The Digital Rebel has a number of commands that change the basic settings of your camera. In this section, we look at those commands.

QuickSteps USING THE SET-UP MENUS

1. With the camera on, press MENU and select the Set-up 1 or Set-up 2 menu tab. (See the box to the left for which command is on which menu.)
2. Highlight any of the commands described in this section and change them as discussed below.
3. Press the MENU or shutter button to hide the menu.

AUTO POWER OFF

Normally the camera will go into sleep mode if you don't take a picture or use any of the commands for a minute. You can select a longer time or even turn this feature off so the camera never goes to sleep.

To turn auto power off or on, highlight *Auto power off* and press SET. Highlight your choice and press SET.

IMAGE REVIEW

- The *Review* command on the shooting menu tab turns off the image display when you take a picture, or displays it with information including a small image, a histogram (page 43), and the settings used to capture the image.
- The *Review Time* command on the same menu tab sets the display time to *2*, *4*, *8* seconds, or *Hold*. *Hold* keeps the image displayed until you press the shutter button halfway down to clear it, or the camera goes to sleep.

AUTO ROTATE

When you rotate the camera into a vertical position to take photos and then play the photos back on the computer screen or TV, everyone watching has to tilt their heads to see the images. To avoid this, the Digital Rebel has an orientation sensor that, when on, senses the position of the camera when you take a picture and automatically rotates pictures you took vertically so they are displayed vertically when played back. Images displayed right after you capture them are not rotated and if you take a vertical image when the camera is pointed up or down, orientation may be confused and not automatically rotate during playback. However, you can rotate these or other pictures manually (page 14).

To turn auto rotate on or off, highlight *Auto rotate* and press SET. Highlight *On* or *Off* and press SET.

LCD BRIGHTNESS

You can adjust the brightness of the monitor so it better matches the lighting conditions you're in at the moment.

To adjust the LCD brightness, highlight *LCD Brightness* and press SET. Turn the Main Dial to select one of five brightness levels, and press SET.

DATE/TIME

When you first use the camera, or when the batteries have been removed or run down for some time, you should set the date and time so your image files are correctly dated.

- To change the setting in the yellow frame, turn the Main Dial.
- To move the yellow frame to the next setting, press SET. When you do so, with mm/dd/yy highlighted, you return to the menu.

TIP

Eventually, you can run through all of the available folder and file numbers. If a folder numbered 999 is created, the message *Folder number full* is displayed on the LCD monitor. Then if a file numbered 9999 is created, *Err CF* is displayed on the LCD panel and in the viewfinder. If this happens replace the CF card or move the files to your computer and format the card.

FILE NUMBERING

By default, each photo you take is given a unique sequential number from 0001 to 9999. The images are stored in folders of 100 or so images each. These folders are numbered from 100 to 999. There are two ways to handle numbering when you change CF cards:

- *Continuous* (the default). Image numbering continues in sequence so you don't have duplicate file names.
- *Auto reset*. Every time you insert a new flash card, file numbering restarts at an initial value of 0001. This can cause problems if you copy images into the same folder on the computer because there can be duplicate file names.

To change the setting, highlight *File numbering* and press SET. Highlight *Continuous* (the default) or *Auto reset* and press SET.

FORMAT

When you get a new CF card, you often have to format it to work with the camera or reformat a card if you ever encounter certain kinds of problems.

To format a card highlight *Format* and press SET to display the prompt *Format CF card?* and the choices *Cancel* and *OK*. Highlight your choice and press SET.

LANGUAGE

You can choose a language for menus and prompts from among English, German, French, Dutch, Danish, Finnish, Italian, Norwegian, Swedish, Spanish, Simplified Chinese, and Japanese.

To change the language, highlight *Language* and press SET. Highlight a language choice and press SET.

DEFAULTS

- AF point selection—Automatic
- Drive mode—Single
- Exposure compensation—0
- AEB—Cancelled
- Quality—Large/fine
- ISO—100
- White balance—AWB (auto)
- WB-BKT—Canceled
- Parameters—Parameter 1
- Auto rotate-On
- File Numbering—Continuous

VIDEO SYSTEM

At rare times you may need to specify a different video system (NTSC or PAL) so you can connect to a TV to give a slide show.

To change the video system, highlight *Video system* and press SET. Highlight *NTCS* or *PAL* and press SET.

COMMUNICATION

Communication controls the transfer of images over your USB connection. *PTP* (Picture Transfer Protocol) is best if you are using Windows XP or Mac OSX (10.1.2 or later) operating systems. If you are using any other operating system, select *Normal*.

To change the setting, highlight *Communication* and press SET. Highlight *PTP* or *Normal* and press SET.

CLEAR ALL CAMERA SETTINGS

As you make changes to settings, it is sometimes easy to forget what you've done. At other times, you've changed so many settings, it's time consuming to reset them all to their original values. For this reason, there is a command that resets all of the settings for you.

To clear all camera settings, set the camera to any mode in the Creative Zone

BEEP, BEEP

■ If you don't want the camera to beep when focus is achieved, you can turn it off with the *Beep* command on the shooting menu tab.

(page 21). Highlight *Clear all camera settings* and press SET. Highlight *OK* and press SET.

SENSOR CLEAN

If any dust or other debris enters the camera and adheres to the image sensor, it may show up as a dark speck in the images. If this happens to you, you can use the menu's *Sensor clean* command to lock the mirror up and out of the way and hold open the shutter so you can clean the image sensor. This is a high-risk procedure, especially if the batteries die during the operation, and we don't recommend it. You should have it done by a Canon Service Center.

FIRMWARE VER

Although you can't update firmware yourself, you can check to see what version has been loaded into the camera.

To see your camera's version number, look at *Firmware Ver*.

On days when you can capture images like this one, life is good.

ENTERING A PRINT ORDER

If you have a DPOF (Digital Print Order Format) compatible printer with a CompactFlash card slot, or if your photofinisher has one, you can create a print order right on the CompactFlash card storing your images. The same procedure can be used to print on a printer capable of direct printing when connected to the camera. When creating a print order, there are three basic steps:

- *Order* selects the images to be printed and specifies how many copies of each are to be made.
- *Set up* specifies print types (*Standard* prints one image on each sheet, *Index* prints a number of small thumbnail images on each sheet, or *Both*) and lets you specify if the date an image was taken and its file number are printed on each photo.
- *All* is used to select all pictures for printing, or to clear all previously specified print quantities.

TIPS

- It's faster to scroll through images displayed in index mode (page 13).
- Images in the RAW file format (page 20) cannot be marked for printing nor can movies or TIFF files captured by other cameras.
- If you specify that both the Date and the File Number be printed on each image, you may not get both. You may get only the date on standard prints and the file number on index prints.

QuickSteps ENTERING A PRINT ORDER

1. With the camera on, press MENU and select the Playback menu tab.
2. Highlight *Print Order* and press SET to display the Print Order menu.
3. Do one of the following:
   - To individually select images to be printed, highlight *Order* and press SET to display the last image taken. Turn the Main Dial to scroll through the images. When you find one you want printed, press the up or down cross key to specify the quantity, and then resume scrolling. (If ordering just index prints, a check mark is displayed instead of a number.) The number of copies of that image, and the running total of all images to be printed are displayed at the top of the monitor. When finished, press MENU to return to the Print Order menu.
   - To select all images for printing, highlight *All* and press SET. Highlight *Cancel*, *Mark all*, or *Clear all* and press SET again to return to the Print Order menu.
   - To specify the print type, highlight *Set up* and press SET. Highlight *Print Type*, press SET, select *Standard*, *Index*, or *Both* and then press SET again. (You can also specify if the date and file number is printed on the image by turning those features on.) When finished, press MENU to return to the Print Order menu.
4. Do one of the following:
   - Press MENU to hide the menu.
   - If you are connected to a printer, highlight *Print* (it only appears when connected), and press SET. Select a print style, then OK to begin printing.

SELECTING AND CREATING PARAMETERS

When you take photographs, the camera automatically adjusts contrast, sharpness, saturation, and color tone when it processes them (unless they are RAW files). If you want, you can select different sets of parameters or even create and save your own.

SELECTING PARAMETERS

The Digital Rebel comes with a number of predefined sets of parameters. They include the following choices:

- *Parameter 1* is the default set and even if you select another, it's still used in all Basic Zone modes. It gives images bright colors.
- *Parameter 2* captures images with more subdued colors.
- *Adobe RGB* is a color space that captures more colors than the sRGB color space normally used. sRGB is suitable for images that will be displayed on a monitor, but if you plan on editing your images and making high-quality prints, Adobe RGB is a better choice. However, if you print them as captured, colors may look very subdued. When you use Adobe RGB, the camera does not attach the necessary ICC profile to the image. You can do so in a program such as Adobe Photoshop but have to remember to do so. If you can't remember which color space was used to capture an image, you can check it's EXIF header information.
- *Set 1 through Set 3* are the custom sets of parameters that you create yourself as described in the section "*Creating Parameters*" on page 117.

QuickSteps SELECTING PARAMETERS

1. With the Mode Dial set to any mode in the Creative Zone, press MENU and select the shooting menu tab.
2. Highlight *Parameters* and press SET to display the choices. (*Parameter 1* is the camera's default setting.)
3. Turn the Mail to highlight your choice and press SET.
4. Press MENU to hide the menu.

TIP

The default *Parameter 1* has contrast, sharpness, and saturation set to +1 and Color tone set to 0. *Parameter 2* sets all four settings to 0.

CREATING PARAMETERS

When you create your own parameters, you do so by selecting one of the three available sets (1–3) and then adjusting its four settings from -2 to +2:

- *Contrast* determines the difference in brightness between the lightest and darkest areas in an image. Minus settings decrease contrast and plus settings increase it.
- *Sharpness* determines how sharp edges appear in an image. Minus settings make an image less sharp and plus settings make it sharper.
- *Saturation* determines the richness of colors. Minus settings decrease saturation and plus settings increase it.
- *Color tone* is the hue of the colors in an image. Minus settings make a skin tone redder and plus settings make it more yellow.

Once you have created a set of parameters, you select it as described in the QuickSteps box "Selecting Parameters" on page 117.

QuickSteps CREATING PARAMETERS

1. With the camera on and the Mode Dial set to any mode in the Creative Zone, press MENU and select the shooting menu tab.
2. Highlight *Parameters* and press SET to display the choices.
3. Highlight *Set up* and press SET to display the settings you can change.
4. Turn the Main Dial to select which of the 3 available parameter sets you want to adjust (it's displayed in the upper right corner of the display) and press SET to highlight *Contrast* with a red frame.
5. To change parameters, do one the following (repeat for each setting you want to adjust):

   ■ To move the red frame to select a parameter to change, turn the Main Dial.

   ■ To change the selected parameter, press SET to display the settings scale, turn the Main Dial to set the parameter, then press SET.
6. Press the MENU or shutter button to hide the menu.
7. To use the set, select it following the steps in the QuickSteps box "Selecting Parameters (page 117).

Here's Quinlan at Boston's Museum of Science exploring how light is formed from a mix of different colors.

CARING FOR YOUR CAMERA

> **TIP**
>
> When cleaning your camera don't use products containing alcohol, benzene, thinners, or other organic solvents.

Some of the best opportunities for interesting photographs occur during bad weather or in hostile environments. You can take advantage of these opportunities as long as you take a few precautions to protect your camera.

CLEANING THE CAMERA AND LENS

Clean the outside of the camera with a slightly damp, soft, lint-free cloth. Open the "flaps" to the memory and battery compartments occasionally and use a soft brush or blower to remove dust. Clean the LCD monitor by brushing or blowing off dirt and wiping with a soft cloth, but don't press hard and be sure there is no grit on the cloth that can scratch the surface. Cleaning kits are available at most office supply stores.

The first rule is to clean the lens only when absolutely necessary. A little dust on the lens won't affect the image, so don't be compulsive. Keep the lens covered when not in use to reduce the amount of cleaning required. When cleaning is necessary, use a soft brush, such as a sable artist's brush, and a blower (an ear syringe makes a good one) to remove dust. Fingerprints can be very harmful to the lens coating and should be removed as soon as possible. Use a lens cleaning cloth (or roll up a piece of photographic lens cleaning tissue and tear the end off to leave a brush like surface). Put a small drop of lens cleaning fluid on the end of the tissue. (Your condensed breath on the lens also works well.) Never put cleaning fluid directly on the lens; it might run between the lens elements. Using a circular motion, clean the lens surface with the cloth or tissue, then use the cloth or a tissue rolled and torn the same way to dry. Never reuse tissues and don't press hard when cleaning because the front element of the lens is covered with a relatively delicate lens coating.

PROTECTING YOUR CAMERA FROM THE ELEMENTS

Your camera should never be exposed to excessively high temperatures. If at all possible, don't leave the camera in a car on a hot day, especially if the sun is shining on the car (or if it will later in the day). If the camera has to be exposed to the sun, such as when you are at the beach, cover it with a light colored and sand free towel or piece of tinfoil to shade it from the sun. Dark materials will only absorb the heat and possibly make things worse. Indoors, avoid storage near radiators or in other places likely to get hot or humid.

When it's cold out, keep the camera as warm as possible by keeping it under your coat. Always carry extra batteries. Those in your camera may weaken at low temperatures just as your car battery weakens in winter. Prevent condensation when taking the camera from a cold area to a warm one by wrapping the camera in a plastic bag or newspaper until its temperature climbs to match that of its environment. If some condensation does occur, do not use the camera or take it back out in the cold with condensation still on it or it can freeze up camera operation. Remove any batteries or flash cards and leave the compartments covers open until everything dries out.

Never place the camera near electric motors or other devices that have strong magnetic fields. These fields can corrupt the image data stored in the camera.

Always protect equipment from water, especially salt water, and from dust, dirt, and sand. A camera case helps but at the beach a plastic bag is even better. When shooting in the mist, fog, or rain, cover the camera with a plastic

bag into which you've cut a hole for the lens to stick out. Use a rubber band to seal the bag around the lens. You can reach through the normal opening in the bag to operate the controls. Screwing a skylight filter over the lens allows you to wipe off spray and condensation without damaging the delicate lens surface.

PROTECTING WHEN TRAVELING

Use lens caps or covers to protect lenses. Store all small items and other accessories in cases and pack everything carefully so bangs and bumps won't cause them to hit each other. Be careful packing photographic equipment in soft luggage where it can be easily damaged. When flying, carry-on metal detectors are less damaging than the ones used to examine checked baggage. If in doubt, ask for hand inspection to reduce the possibility of X-ray induced damage.

STORING A CAMERA

Store cameras in a cool, dry, well ventilated area, and remove the batteries if they are to be stored for some time. A camera bag or case makes an excellent storage container to protect them from dust.

Digital cameras have lots of components including batteries, chargers, cables, lens cleaners, and what not. It helps if you have some kind of storage container in which to keep them all together.

CARING FOR YOURSELF

When hiking outdoors, don't wear the camera strap around your neck, it could strangle you. Don't aim the camera directly at the sun, it can burn the eye.